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TOXIC POTENTIAL ASSESSMENT OF MUNICIPAL WASTEWATER TREATMENT PLANT EFFLUENTS IN QUEBEC

FINAL REPORT

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- Environment Canada

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ABSTRACT

BACKGROUND OF THE STUDY

Major financial and technical resources have been marshalled over the last 20 years to recover use of Quebec's watercourses. Some $7 billion has been spent within the framework of two water cleanup programs: the *Programme d'Assainissement des Eaux du Québec* (PAEQ) and the *Programme d'Assainissement des Eaux Municipales du Québec* (PADEM). By virtue of these programs, 98% of the Quebec population with existing sewer services were connected up to wastewater treatment plants. Observed trends and changes in contaminant loads over time suggest that the water cleanup initiatives begun in 1979 have had positive effects on the water quality of Quebec rivers. Time series analyses of nitrite-nitrates, ammonia nitrogen, total phosphorus, turbidity and fecal coliforms reveal a preponderant downward trend. Loads of biochemical oxygen demand (BOD_5) and suspended matter (SM) in municipal effluents are also diminishing.

Despite the improved quality of effluents released to watercourses in the wake of the PAEQ and PADEM programs, however, it is possible that certain municipal effluents are potentially toxic to some aquatic species. Municipal effluents may also contain persistent and bioaccumulable substances that can degrade the quality of the flesh of organisms exposed to them.

Studies and toxicity tests conducted throughout North America have revealed the toxicity of many municipal treatment plant effluents. Some effluents were highly toxic, causing the death of organisms within a short time (acute lethal toxicity), while others had more long-term effects (chronic toxicity). These studies established that chlorine disinfection and the presence of ammonia nitrogen at elevated concentrations were major, generalized causes of the toxicity measured. In the case of ammonia nitrogen, toxicity was especially evident in winter, when nitrification is reduced. Hydrogen sulfide was identified as an additional cause of toxicity in unaerated lagoons. Other substances, such as metals, surfactants and some organic compounds, may also contribute to the toxicity of municipal effluents. The problem of effluent toxicity in Quebec was less well understood as few toxicity tests had yet been conducted.

In light of this information, and given the progress of the water cleanup programs, the Quebec Environment Ministry (MENV) decided in 1993 to strike a committee mandated to determine the means by which to assess the toxic potential of effluents generated by municipal wastewater treatment plants in Quebec. The committee first concluded that very few effluents could be toxic due to chlorine disinfection since only two treatment plants in the province continued to employ this process at the time (both plants have since replaced this method with ultraviolet disinfection). The committee also concluded that several plants, primarily aerated lagoons in winter, could present an elevated risk of toxicity due to the presence of high concentrations of ammonia nitrogen.

The committee recommended that the effluents of 15 municipal treatment plants be characterized. These 15 plants were selected for their representativeness in terms of treatment processes employed in Quebec, and for their different operating conditions (i.e. with/without chemical dephosphatization; with/without major industrial inputs). The committee also recommended that this campaign be undertaken over two different periods, in winter and summer operating conditions.

Implementation of the characterization campaign and production of the present study were made possible under the aegis of a Quebec-Canada harmonization agreement: the *St. Lawrence Vision 2000* Program (SLV 2000).

OBJECTIVES AND INTERPRETATIVE LIMITATIONS OF THE STUDY

The objective of the study was to obtain a comprehensive and representative snapshot of the toxic potential of municipal treatment plant discharges — that is, to assess the toxicity of undiluted effluents without taking account of the particularities of receiving environments or loads discharged. The approach adopted for this study made it possible to compare the municipal effluents on a common basis in order to:

- assess end-of-pipe toxicity (acute or chronic) of treated wastewater discharges of municipal treatment plants;
- point up the substances that are the likely sources of the measured toxicity;
- identify the common causes of toxicity and the effect of certain factors that might influence effluent toxicity.

This approach, however, does not allow for a cause-and-effect link to be made between measured toxicity and potential effects on the environment. The toxicity of various contaminants may be modified due to certain environmental characteristics of receiving environments, such as water hardness, pH, temperature, the presence of other substances, degradation of parent products into more or less toxic by-products, the health of populations present, etc. Concentrations alone are inadequate to assess the apprehended impact of an effluent on its receiving environment; consideration must also be given to loads discharged, physical (flow, hydrodynamics, deposition zones) and chemical characteristics of the specific receiving environment.

This study looked only at the toxicity of effluents without taking account of other possible impacts of municipal wastewater discharges on a body of water. The physical impacts of effluents and sewer overflows (volumes of excess water released untreated during episodes of heavy rainfall or spring snowmelt) on habitats, as well as the thermal, aesthetic and microbiological impacts were not assessed. The aspect of the toxicity of overflow water was not addressed, either.

Lastly, due to the low sampling rate, we were unable to process the results statistically or to characterize the recognized variability of municipal wastewaters.

EXPERIMENTAL APPROACH AND TOOLS FOR ASSESSING TOXIC POTENTIAL

The 15 municipal wastewater treatment plants selected are representative of the main treatment processes used in Quebec (see Table 1). Seven of these plants are associated with a major industrial-source load; four use chemical dephosphatization (phosphorus removal) year-round, six do so only in summer, and five plants do no phosphorus removal whatsoever. All the plants were characterized over a period stretching from 1996 to 1999, mostly over two seasons, winter and summer. During these sampling campaigns, all plants functioned normally and, overall, respected the discharge requirements (BOD_5, SM and P_T) for which they were designed.

TABLE 1: CHARACTERISTICS OF SELECTED MUNICIPAL TREATMENT PLANTS

Process	**Number of treatment plants**			
	Low industrial inputs		**High industrial inputs**	
	With dephosphatization	**Without dephosphatization**	**With dephosphatization**	**Without dephosphatization**
Activated sludge	1	1	2	1
Aerated lagoon	1	1	2	1
Biofiltration	1	1	-	-
Physico-chemical	1	-	1	-
Unaerated lagoon	1	-	-	-

Sampling was carried out over three inconsecutive days for each season. In all, seven toxicity tests were performed and up to 26 conventional physico-chemical parameters, 19 metals and eight families of chlorinated and unchlorinated organic substances were analysed in the samples drawn (see tables 2 and 3). While the comparison of results for certain substances may be biased due to changes in the analytical profile over the course of the project, our experimental protocol produces a representative snapshot of the quality and potential toxicity of municipal wastewaters under normal plant operating conditions.

Toxic potential is assessed using a complementary, three-pronged approach: studying the amplitude of exceedances of water quality criteria for the chemicals analysed, studying the amplitude of exceedances of overall toxicity criteria for toxicity tests, and studying the compilation of so-called "toxic prints", which are toxicity measuring components of the Potential Ecotoxic Effects Probe (PEEP) Index. With this approach, the substances proper to municipal wastewater treatment plants can be identified, as can the toxicity of the effluents and the substances likely to be responsible. The importance of treatment process type, effect of industrial source loading, presence of a chemical dephosphatization process or effectiveness of treatment by season of the year can also be determined.

TABLE 2: TOXICITY TESTS USED AND DESCRIPTIVE CHARACTERISTICS

Organism	Species	Trophic level	Toxicity level	Variable of effect
Marine bacteria	*Vibrio fischeri* (Microtox™)	Decomposer	Acute sublethality	Inhibition of luminescence
Bacteria	*Escherichia coli* PQ37 (SOS Chromotest)	Decomposer	Chronic sublethality	Genotoxicity and cell viability
Algae	*Selenastrum capricornutum*	Primary producer	Chronic sublethality	Inhibition of cell division
Cladocerans (crustaceans)	*Ceriodaphnia dubia*	Primary consumer	Chronic lethality and sublethality	Mortality and reproductive inhibition
Cladocerans (crustaceans)	*Daphnia magna*	Primary consumer	Acute lethality	Mortality
Fish larvae	*Pimephales promelas* (Fathead minnow)	Secondary consumer	Chronic lethality and sublethality	Mortality and growth inhibition
Fish	*Oncorhynchus mykiss* (Rainbow trout)	Secondary consumer	Acute lethality	Mortality

TABLE 3: LIST OF PARAMETERS ANALYSED AT TREATMENT PLANTS

Physical/chemical parameters (PCP)	Metals	Organic substances
• Conventional parameters: pH, dissolved oxygen (DO) and temperature Conductivity Total hardness (in $CaCO_3$) Total organic carbon (TOC) Biochemical oxygen demand (BOD_5) Carbonated BOD ($CBOD_5$) Chemical oxygen demand(COD) Suspended matter (SM) Total solids (TS) • Nutrients: Ammonia nitrogen ($N\text{-}NH_3\text{-}NH_4^+$) Total Kjeldahl nitrogen (N-TKN) Nitrites (NO_2) Nitrites-nitrates ($NO_2\text{-}NO_3$) Total phosphorus (P_T) • Major ions: Chlorides (Cl^-) Total residual chlorine (TRC) Cyanates (CNO^-) Total cyanides (CN^-) Total fluorides (F^-) Sulfates (SO_4^{2-}) Dissolved sulfides (S^{2-} dis.) Total sulfides (S^{2-} tot.) • Oils and greases: Total hydrocarbons Freon extractibles	• Aluminum (Al) • Antimony (Sb) • Arsenic (As) • Barium (Ba) • Beryllium (Be) • Boron (B) • Cadmium (Cd) • Chromium (Cr) • Cobalt (Co) • Copper (Cu) • Iron (Fe) • Lead (Pb) • Mercury (Hg) • Molybdenum (Mo) • Nickel (Ni) • Selenium (Se) • Silver (Ag) • Vanadium (V) • Zinc (Zn)	• Phenolic substances • Semi-volatile organic substances (SVOCs): Scan of over 50 organic substances • Volatile organic substances (VOCs): Scan of over 40 organic substances • Nonionic and anionic surfactants • Polychlorinated biphenyls (PCBs): 43 specific congeners Homologues • Polycyclic aromatic hydrocarbons (PAHs): 22 specific PAHs • Chlorinated dioxins and furans: 17 specific congeners Homologues • Pesticides: 32 organophosphorus and other pesticides 14 phenoxyacid herbicides

RESULTS OF PHYSICO-CHEMICAL ANALYSES AND TOXIC POTENTIAL BASED ON THE AMPLITUDE OF EXCEEDANCES OF WATER QUALITY CRITERIA FOR SUBSTANCES ANALYSED

The variable quality of municipal effluents was recognized upon examining the analytical results. The toxic responses and measured concentrations of several substances differed significantly from one sampling day to the next. Seasonal variations were also observed for some substances, including those that depend upon biological activity during wastewater treatment, such as ammonia nitrogen and hydrogen sulfide, or where their use is seasonal, like the chlorides used in road de-icing agents.

The substances most frequently detected in samples drawn at the 15 plants are shown in Table 4. Since they were detected in more than 85% of samples analysed, the results suggest that these substances are likely to be found in the wastewaters of a number of plants in Quebec.

TABLE 4: SUBSTANCES DETECTED IN MORE THAN 85% OF SAMPLES ANALYSED

Nutrients	**Major ions**	**Metals**	**Organic substances**
Ammonia nitrogen Nitrites and nitrates Phosphorus	Chlorides Fluorides Sulfates	Aluminum Arsenic Barium Boron Chromium Copper Iron Mercury (1)	PCBs Chlorinated dioxins and furans Herbicides (2) PAHs Anionic surfactants

(1): Frequency exceeds 85% in samples drawn in 1998–99 due solely to the use of a method with a better detection limit.

(2): Pesticides (herbicides and insecticides) were analysed in 42 samples drawn from two plants alone. Only the herbicides 2,4-D and mecoprop were detected in more than 85% of samples.

Although these substances are practically ubiquitous in the wastewaters of all 15 plants, they are not necessarily found in effluent at concentrations deemed toxic or harmful. Many did not exceed water quality criteria (sulfates, barium, boron, and herbicides) or showed a few specific low-range exceedances (chlorides, fluorides, iron, and PAHs).

Of those pesticides used in urban applications, seven were detected in effluents of the two treatment plants where these analyses were performed. These were herbicides 2,4-D, mecoprop and dicamba, all of which are contained in commercial lawn treatment mixtures, as well as the insecticides diazinon, carbaryl, malathion and chlorpyrifos. Other pesticides applied on field crops were also detected: in municipal effluents; their presence is probably attributable to atmospheric transport from the farmbelts surrounding urban areas. In summer, concentrations of pesticides, and most especially herbicides, appear to swell during rainfall events due to urban runoff. These results have been corroborated by other studies conducted in Ontario and the U.S.

An examination of the amplitude of exceedances of the quality criteria for the protection of aquatic life shows that there are frequent exceedances for certain substances, with some attaining high amplitudes (> 10). This is true for ammonia nitrogen, phosphorus, hydrogen sulfide, aluminum, silver, chromium, copper, two insecticides (diazinon and chlorpyrifos) and, most especially, surfactants. Indeed, wherever nonionic and anionic surfactants were detected, they exceeded the water quality criteria, and the exceedances are substantial in the majority of cases. The presence of these substances at such concentrations suggests that municipal wastewater presents a toxic potential that is harmful to aquatic life in the long term, particularly in watercourses with only a moderate assimilative capacity.

Other substances known to be toxic and highly bioaccumulable appear to be ubiquitous, and were detected at significant concentrations relative to the quality criteria for the prevention of contamination of aquatic organisms. This is the case for PCBs and chlorinated dioxins and furans, and, to a lesser extent, mercury. These substances can contaminate the flesh or tissue of fish, molluscs and crustaceans, making them unfit for unrestricted consumption. These substances can be even more harmful to fish-eating land animals, as the quantity of fish they consume is greater than that consumed by humans and because they eat the entire organism, including those tissues where bioaccumulation is greater than in flesh.

The sources of these bioaccumulable substances in municipal wastewaters, especially PCBs and chlorinated dioxins and furans, are many and complex. Other than industrial discharges, these substances may come from relatively distant atmospheric sources and contaminate urban runoff waters as well as the aquatic receiving environments from which municipalities draw their water supply. Only mass balance studies of the municipal network would enable us to determine the inputs of various sources being channelled to municipal treatment plants.

TOXIC POTENTIAL FOR AQUATIC LIFE BASED ON TOXICITY TESTS OF THE MENV APPROACH FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT

With acute toxicity tests, there are few exceedances of the overall toxicity criteria of 1 acute toxic unit (TUa) and they are of low amplitude, in the majority of cases. More than half of the treatment plants studied (53%) had no result above 1 TUa. Twenty-two percent of samples were toxic to rainbow trout, with 11% being toxic to *Daphnia magna*. For purposes of comparison, a similar study in Ontario in 1992 shows corresponding percentages of 56% and 27%, respectively. These differences mainly have to do with the fact that, unlike many plants in Ontario, Quebec treatment plants use no chlorine treatment to disinfect their wastewater.

Ammonia nitrogen, at concentrations greater than 10 mg/L, appears to be mainly responsible for the acute toxicity measured. Surfactants may be the second most generalized contaminant while nitrites are suspected at one plant. The presence of pesticides in summer could be another cause of toxicity.

Chronic toxicity effects were measured in the undiluted effluents of almost all the plants, but, overall, exceedances of the overall toxicity criteria of 1 TUc are of low amplitude (responses of 1 to 2 TUc), which suggests that there will be few or no effects on the environment once the effluent mixes into the watercourse. All seasons combined, a little over one-third of the plants obtained results above 10 TUc, thereby making these effluents potentially harmful to aquatic life in watercourses with a weak assimilative capacity. One plant obtained results above 30 TUc.

Almost all the samples stimulated algal growth. This positive response in the algae *Selenastrum capricornutum* was not quantified in terms of toxic units, but it does nonetheless indicate the potential harm of the eutrophication process for aquatic life.

Those substances most likely to have contributed to the chronic toxicity measured are ammonia nitrogen, a few metals (mainly copper, chromium and aluminum), surfactants and, probably, certain pesticides including diazinon and chlorpyrifos. In some specific cases, nitrites, cyanides or hydrogen sulfide might have played a role. In all these cases, though, the expression of chronic effects coincides with the simultaneous presence of several substances at concentrations greater than safe limits.

Toxicity identification evaluations (TIEs) are the only way to determine, on a case-by-case basis, which substances are responsible for chronic and acute toxicity.

TOXIC POTENTIAL BASED ON TOXIC PRINTS OF THE PEEP INDEX

No threshold or criterion has yet been established to indicate a worrisome or harmful level relative to toxic prints of the Potential Ecotoxic Effects Probe (PEEP) Index. Although it is impossible to reach any conclusions about the toxic potential of municipal effluents in terms of toxic prints, this tool does allow us to better define wastewater quality, and has proven useful to interpreting the results.

The genotoxicity test was particularly sensitive to municipal wastewater, with toxic responses observed at more than two out of three plants. These results suggest that undiluted municipal effluents may contain substances at concentrations capable of altering bacterial DNA.

INFLUENCE OF SEASON, TREATMENT TYPE, INDUSTRIAL LOADING AND DEPHOSPHATIZATION ON TOXIC POTENTIAL

The results of the study indicate that the toxic potential of municipal effluents in Quebec varies from one plant to another. Effluents of aerated lagoons that were characterized during winter operating conditions are often acutely toxic for rainbow trout because of the elevated concentrations of ammonia nitrogen. Treatment processes that don't include aeration equipment (unaerated lagoons and physico-chemical processes) may present a higher toxic potential at certain times of the year (during spring emptying of unaerated lagoons and in summer for physico-chemical treatment) due to the biological production of hydrogen sulfide under anaerobic conditions.

Plant effluents that are subject to major industrial loading were, overall, more toxic than those of plants with low industrial inputs. Our results show that industrial inputs appear to be a determining factor in the toxic potential of municipal effluents, even though effluents may be toxic where there is little or no industrial input.

In addition to removing phosphorus, chemical dephosphatization had a beneficial effect on the removal of metals. In contrast, though, it does seem to lead to an increase in the concentration of metal serving as a coagulant. Although chemical phosphorus removal also appears to have a beneficial effect on the potential toxicity of municipal effluents, it is impossible to say so with any certainty, since the toxicity test results obtained in this study are much more influenced overall by treatment type, season of the year and industrial load than by dephosphatization.

CONCLUSION ON ANALYTICAL METHODS AND SAMPLES USED

The use of the best analytical techniques made it possible to lower detection limits and thus obtain a better snapshot of the quality of municipal wastewater, in addition to producing results that are comparable to defined safety limits (water quality criteria) for several substances and metals. Our use of these best techniques also allowed us to point up the presence of substances rarely quantified in this type of effluent (e.g. PCBs and chlorinated dioxins and furans).

Unlike studies conducted elsewhere, this study targeted pesticides that are likely to be found in the urban environment. This proved useful to the task of selecting the appropriate analytical methods to point up the presence of these pesticides in municipal wastewaters.

In the case of municipal effluents, scanning analytical methods for semi-volatile and volatile organic substances were found to be lacking in specificity and resolution. It might be better to target a small number of substances, e.g. the 20-odd VOCs used in laboratory accreditation processes.

The present study confirmed yet again the importance of using a number of different toxicity tests to adequately assess effluent toxicity because of the variability of contaminants present in samples, which can cause a reaction in one species and not in an other.

GENERAL CONCLUSIONS

The municipal cleanup initiatives begun in Quebec in 1979 have had positive effects on the quality of watercourses. Treatment plants built in the context of these cleanup programs were specifically designed to reduce the main contaminants contained in municipal wastewaters; that is, conventional parameters (BOD_5, SM, phosphorus and fecal coliforms). Although these plants can attain a certain yield for the removal of other contaminants potentially contained in municipal wastewaters, they cannot eliminate them completely.

This study characterized the effluents of 15 different municipal treatment plants. The toxicity test results show that although the treated wastewaters of almost all the plants studied are toxic, they expressed, with only a few exceptions, low amplitude toxicity to the test species.

The main substance responsible for the toxicity measured appears to be ammonia nitrogen, at concentrations above 10 mg/L. During winter, when the nitrification process is reduced, concentrations of ammonia nitrogen are higher, especially in aerated lagoons. Anionic surfactants are next, followed, to a lesser extent, by nonionic surfactants. Surfactants are organic molecules that enter into the composition of hundreds of products used, among other things, as cleaning agents for both domestic and industrial purposes. Finally, other substances, like certain pesticides and metals, could also be responsible for the toxicity measured.

This study points up the ubiquitousness of a number of substances in the municipal wastewaters of 15 treatment plants, including certain organic substances rarely quantified in other studies and found at concentrations that could impair use of the water. These are, namely, surfactants, PCBs and chlorinated dioxins and furans. Certain pesticides may be added to the list in summer during rainfall events. However, to assess the actual impact of these substances, discharge loads must be considered and, in each case, sound information held on the biophysical and chemical characteristics of the respective receiving environments.

The significance of industrial inputs to treatment plants appears to be a determining factor in the toxic potential of municipal effluents, even though effluents may be toxic where there is little or no industrial input.

RECOMMENDATIONS

Those municipal treatment plants that do respect their discharge requirements may have a difficult time further reducing the toxicity of their effluents. Adding equipment to this end may be costly and relatively ineffective given the significance of the discharges and the dilution of contaminants. *The focus would be better directed toward at-source reduction* where intervention may be much cheaper and more effective, particularly with regard to industrial-source contaminants. In this way, public-education initiatives should also be envisaged to reduce the use of certain contaminants that are widely employed for domestic purposes, especially pesticides and surfactants.

Nonetheless, *other solutions must be found to problems inherent to certain treatment types in order to reduce effluent toxicity*. This is the case, for example, for aerated lagoons having concentrations of ammonia nitrogen that exceed 10 mg/L in winter. Although the selection criteria in this study rejected plants with elevated concentrations of ammonia nitrogen, we were nonetheless able to establish a link between this parameter and effluent toxicity. Several Quebec treatment plants show elevated concentrations of ammonia nitrogen. Based on all the data collected since 1995, 16 municipal treatment plants have obtained at least one result above 50 mg/L of ammonia nitrogen, and 27 plants (or 5% of plants in Quebec) obtained a general average greater than 10 mg/L. The highest concentrations are generally due to the presence of industrial plants, especially the agri-food sector, for which at-source reductions remain the best solution.

Just as in previous studies, the present study demonstrates that municipal treatment plants can be a source of contaminants at levels that are sometimes toxic or harmful to use of the water. We are not in a position to make any determinations on the impact of these effluents on their respective receiving environments. To do so, *the sampling frequency of a complete characterization of the effluents must be higher in order to consider variability, and the results should be analysed against environmental discharge objectives (EDO)*. EDOs are based on the quality criteria applicable to different uses of the water, and they take account of specifics of the effluent (especially flow rate) and characteristics of receiving environments.

The establishment of EDOs for the substances present in effluents and for overall toxicity, as measured by toxicity tests, is proving to be essential to determining the problems apprehended in a specific environment and to identifying the substances responsible, on a case-by-case basis. However, *municipal effluents are not the sole source of contamination of receiving environments. Inputs should be assessed as a function of other sources* such as sewer overflows of untreated wastewater, urban runoff, agricultural pollution, industries not connected up to municipal sewer systems, atmospheric deposition, upwellings of water on contaminated land, and sanitary landfill sites.

Lastly, *basic data on the water quality of receiving environments is also vital to this process.* Where it exists at all, real data on the majority of toxic substances in most water bodies is incomplete. *The MENV should continue to seek more such information and target problem substances on a priority basis.*

RÉSUMÉ

CONTEXTE DE L'ÉTUDE

D'importants moyens financiers et techniques ont été mis en œuvre depuis plus de 20 ans afin de récupérer les usages des cours d'eau du Québec. Environ sept milliards de dollars ont été dépensés dans le cadre du *Programme d'assainissement des eaux du Québec* (PAEQ) et du *Programme d'assainissement des eaux municipales* (PADEM). Ces programmes ont permis de raccorder à une station d'épuration 98 % de la population desservie par un réseau d'égouts. Les tendances observées dans les cours d'eau et l'évolution temporelle des charges suggèrent que les interventions d'assainissement des eaux réalisées depuis 1979 ont eu des effets positifs sur la qualité de l'eau des rivières du Québec. L'analyse des séries chronologiques des nitrites-nitrates, de l'azote ammoniacal, du phosphore total, de la turbidité et des coliformes fécaux révèle une prépondérance de tendances à la baisse. Les charges en demande biochimique en oxygène (DBO_5) et en matières en suspension (MES) provenant des eaux usées municipales sont également en baisse.

Malgré l'amélioration de la qualité des eaux rejetées dans les cours d'eau suite à la réalisation du PAEQ et du PADEM, il est possible que certains effluents municipaux présentent un potentiel toxique pour certaines espèces aquatiques. Les effluents municipaux peuvent aussi contenir des substances persistantes et bioaccumulables pouvant dégrader la qualité des tissus des organismes aquatiques qui y sont exposés.

Des études et des tests de toxicité effectués sur les effluents de stations d'épuration municipales un peu partout en Amérique du Nord ont révélé que plusieurs étaient toxiques. Certains effluents étaient fortement toxiques, causant la mort d'organismes en peu de temps (toxicité létale aiguë). D'autres avaient des effets à plus long terme (toxicité chronique). Ces études ont établi que la désinfection au chlore et la présence d'azote ammoniacal à des concentrations élevées étaient des causes généralisées importantes de la toxicité mesurée. Dans le cas de l'azote ammoniacal, la toxicité se produisait surtout l'hiver lorsque la nitrification est réduite. Le sulfure d'hydrogène a été identifié comme une cause additionnelle de la toxicité dans les étangs non aérés. D'autres substances comme les métaux, les surfactants et certains composés organiques pouvaient également contribuer à la toxicité des effluents municipaux. Au Québec, la problématique de la toxicité des effluents municipaux était moins bien connue puisque peu de tests de toxicité avaient été réalisés.

À la lumière de ces informations, et compte tenu de l'état d'avancement des programmes d'assainissement au Québec, le ministère de l'Environnement du Québec décidait en 1993 de former un comité dont le mandat était de déterminer les moyens à utiliser pour évaluer le potentiel toxique des effluents des stations d'épuration municipales du Québec. Le comité a d'abord conclu que bien peu de stations au Québec pouvaient présenter une toxicité due à la désinfection au chlore puisque seules deux stations utilisaient encore la chloration à cette époque,

méthode remplacée depuis par une désinfection aux ultraviolets. Le comité a également conclu que plusieurs stations, principalement des étangs aérés en hiver, pouvaient présenter des risques de toxicité dus à la présence de fortes concentrations d'azote ammoniacal.

Les recommandations du Comité étaient de procéder à la caractérisation des effluents de 15 stations d'épuration municipales, sélectionnées pour être représentatives non seulement de l'ensemble des principaux procédés de traitement existants au Québec, mais aussi des différentes conditions d'opération (i.e. avec et sans déphosphatation chimique; avec et sans apport industriel important). Il recommandait aussi que cette campagne soit réalisée à deux périodes différentes, soit en conditions d'opération hivernales et estivales.

La mise en œuvre de la campagne de caractérisation et la production de la présente étude ont été réalisées par le biais de l'entente d'harmonisation Québec-Canada : le programme *Saint-Laurent Vision 2000* (SLV 2000).

OBJECTIFS ET LIMITES D'INTERPRÉTATION DE L'ÉTUDE

L'objectif de l'étude était d'obtenir un portrait global et représentatif du potentiel toxique des rejets des stations d'épuration municipales, c'est-à-dire évaluer la toxicité des effluents non dilués sans tenir compte des particularités des milieux récepteurs ou de la charge rejetée. L'approche utilisée permet de comparer les effluents municipaux sur une base commune de façon à :

- évaluer la toxicité (aiguë et chronique) des rejets d'eaux usées traitées des stations d'épuration municipales à l'effluent (en bout de tuyau);
- mettre en évidence les substances susceptibles d'être à l'origine de la toxicité mesurée;
- identifier les causes communes de la toxicité et l'effet de certains facteurs pouvant influencer la toxicité à l'effluent.

Cette approche ne permet toutefois pas de faire un lien de cause à effet entre la toxicité mesurée et les effets potentiels sur le milieu. En effet, la toxicité de divers contaminants peut être modifiée en raison de certaines caractéristiques environnementales du milieu récepteur telles que la dureté, le pH, la température, la présence d'autres substances, la dégradation de produits parents en produits plus ou moins toxiques, la santé des populations présentes, etc. Pour évaluer l'impact appréhendé d'un effluent sur son milieu récepteur, il faut considérer, en plus des concentrations, les charges rejetées ainsi que les caractéristiques physiques (débit, hydrodynamisme, zones de déposition) et chimiques du milieu récepteur spécifique.

L'étude s'est limitée à l'aspect toxicité des effluents sans tenir compte des autres impacts possibles occasionnés par le rejet d'eaux usées municipales dans un cours d'eau. Les impacts physiques des effluents et des eaux de débordement (volumes d'eaux usées excédentaires rejetés sans traitement lors d'épisodes de pluies ou de fonte printanière) sur les habitats ainsi que les impacts thermiques, esthétiques et microbiologiques n'ont pas été évalués. L'aspect toxique des eaux de débordement n'a pas non plus été abordé.

Finalement, le faible échantillonnage ne permet pas de faire un traitement statistique des résultats et de caractériser la variabilité reconnue des eaux usées municipales.

APPROCHE EXPÉRIMENTALE ET OUTILS D'ÉVALUATION DU POTENTIEL TOXIQUE

Les quinze stations d'épuration municipales sélectionnées sont représentatives des principaux procédés de traitement utilisés au Québec (voir tableau 1). Sept d'entre elles sont associées à une charge industrielle importante. Quatre stations procèdent à la déphosphatation chimique toute l'année, six la font de façon saisonnière en période estivale et cinq stations ne font aucune déphosphatation. Elles ont été caractérisées sur une période s'échelonnant de 1996 à 1999, au cours de deux saisons pour la plupart, soit en hiver et en été. Durant les échantillonnages, toutes les stations ont fonctionné normalement et ont dans l'ensemble respecté les exigences de rejet (DBO_5, MES et P_t) pour lesquelles elles ont été conçues.

TABLEAU 1 : CARACTÉRISTIQUES DES STATIONS D'ÉPURATION MUNICIPALES SÉLECTIONNÉES

Procédé	**Nombre de stations d'épuration**			
	Faible apport industriel		**Fort apport industriel**	
	Avec déphosphatation	**Sans déphosphatation**	**Avec déphosphatation**	**Sans déphosphatation**
Boues activées	1	1	2	1
Étangs aérés	1	1	2	1
Biofiltration	1	1	-	-
Physico-chimique	1	-	1	-
Étangs non aérés	1	-	-	-

L'échantillonnage s'est déroulé sur trois jours non consécutifs à chaque saison. En tout, sept tests de toxicité ont été réalisés et jusqu'à 26 paramètres physico-chimiques génériques, 19 métaux et 8 familles de substances organiques chlorées et non chlorées ont été analysés dans les échantillons recueillis (voir tableaux 2 et 3). Bien qu'il puisse y avoir un biais dans la comparaison des résultats pour certaines substances en raison des modifications qui ont été apportées au profil analytique au cours du projet, le protocole expérimental utilisé permet d'obtenir un portrait représentatif de la qualité et de la toxicité potentielle des eaux usées municipales et ce, en conditions normales d'opération des stations.

TABLEAU 2 : TESTS DE TOXICITÉ UTILISÉS ET CARACTÉRISTIQUES DESCRIPTIVES

Organisme	**Espèce**	**Échelon trophique**	**Niveau de toxicité**	**Variable d'effet**
Bactéries marines	*Vibrio fischeri* (Microtox™)	Décomposeur	Sublétalité aiguë	Inhibition de la luminescence
Bactéries	*Escherichia coli* PQ37 (SOS Chromotest)	Décomposeur	Sublétalité chronique	Génotoxicité et viabilité cellulaire
Algues	*Selenastrum capricornutum*	Producteur primaire	Sublétalité chronique	Inhibition de la division cellulaire
Cladocères (crustacés)	*Ceriodaphnia dubia*	Consommateur primaire	Létalité et sublétalité chronique	Mortalité et inhibition de la reproduction
Cladocères (crustacés)	*Daphnia magna*	Consommateur primaire	Létalité aiguë	Mortalité
Larves de poisson	*Pimephales promelas* (Tête-de-boule)	Consommateur secondaire	Létalité et sublétalité chronique	Mortalité et inhibition de la croissance
Poissons	*Oncorhynchus mykiss* (Truite arc-en-ciel)	Consommateur secondaire	Létalité aiguë	Mortalité

TABLEAU 3 : LISTE DES PARAMÈTRES ANALYSÉS AUX STATIONS D'ÉPURATION

Paramètres physico-chimiques (PPC)	**Métaux**	**Substances organiques**
• Paramètres conventionnels : pH, oxygène dissous (OD) et température Conductivité Dureté totale (en $CaCO_3$) Carbone organique total (COT) Demande biochimique en oxygène (DBO_5) DBO carbonée (DBO_5C) Demande chimique en oxygène (DCO) Matières en suspension (MES) Solides totaux (ST) • Éléments nutritifs : Azote ammoniacal ($N\text{-}NH_3\text{-}NH_4^+$) Azote total Kjeldahl (N-NKT) Nitrites (NO_2) Nitrites-nitrates ($NO_2\text{-}NO_3$) Phosphore total (P tot.) • Ions majeurs : Chlorures (Cl^-) Chlore résiduel total (CRT) Cyanates (CNO^-) Cyanures totaux (CN^-) Fluorures totaux (F^-) Sulfates (SO_4^{2-}) Sulfures dissous (S^{2-} dis.) Sulfures totaux (S^{2-} tot.) • Huiles et graisses : Hydrocarbures totaux Matières extractibles au fréon	• Aluminium (Al) • Antimoine (Sb) • Argent (Ag) • Arsenic (As) • Baryum (Ba) • Béryllium (Be) • Bore (B) • Cadmium (Cd) • Chrome (Cr) • Cobalt (Co) • Cuivre (Cu) • Fer (Fe) • Mercure (Hg) • Molybdène (Mo) • Nickel (Ni) • Plomb (Pb) • Sélénium (Se) • Vanadium (V) • Zinc (Zn)	• Substances phénoliques • Substances organiques semi-volatiles (SOBN) : Balayage de plus de 50 substances organiques • Substances organiques volatiles (SOV) : Balayage de plus de 40 substances organiques • Surfactants non ioniques et anioniques • Biphényles polychlorés (BPC) : 43 congénères spécifiques Groupes homologues • Hydrocarbures aromatiques polycycliques (HAP) : 22 HAP spécifiques • Dioxines et furanes chlorés : 17 congénères spécifiques Groupes homologues • Pesticides : 32 pesticides organophosphorés et autres 14 herbicides phénoxyacides

L'approche d'évaluation du potentiel toxique adoptée comporte trois outils d'évaluation complémentaires : l'étude de l'amplitude des dépassements des critères de qualité de l'eau pour les substances chimiques analysées; l'étude de l'amplitude des dépassements des critères de toxicité globale pour les tests de toxicité; puis l'étude de la compilation des toximesures, l'une des composantes de l'indice BEEP. Cette approche permet de faire ressortir les substances propres aux eaux usées des stations d'épuration municipales ainsi que la toxicité des effluents et les substances susceptibles d'en être responsables. Elle permet aussi de juger de l'importance du type de procédé de traitement, de l'effet de la charge industrielle, de la présence d'un procédé de déphosphatation chimique ou de l'efficacité des traitements en fonction des saisons.

RÉSULTATS DES ANALYSES PHYSICO-CHIMIQUES ET POTENTIEL TOXIQUE SELON L'AMPLITUDE DES DÉPASSEMENTS DES CRITÈRES DE QUALITÉ DE L'EAU POUR LES SUBSTANCES ANALYSÉES

L'un des premiers constats qui s'impose à l'examen des résultats analytiques est la variabilité de la qualité des eaux usées municipales. Les réponses toxiques et les concentrations mesurées pour plusieurs substances varient significativement d'une journée d'échantillonnage à l'autre. Une variation saisonnière a également été observée pour certaines substances, dont celles qui dépendent de l'activité biologique lors du traitement des eaux usées, tels l'azote ammoniacal et le sulfure d'hydrogène, ou dont l'utilisation est saisonnière, tels les chlorures utilisés dans les fondants pour le déglaçage des routes.

Les substances les plus fréquemment détectées dans les échantillons prélevés aux 15 stations sont présentées au tableau 4. Comme elles ont été détectées dans plus de 85 % des échantillons analysés, ces résultats suggèrent que ces substances sont susceptibles de se retrouver dans les eaux usées de plusieurs stations au Québec.

TABLEAU 4 : SUBSTANCES AYANT ÉTÉ DÉTECTÉES DANS PLUS DE 85 % DES ÉCHANTILLONS ANALYSÉS

Éléments nutritifs	**Ions majeurs**	**Métaux**	**Substances organiques**
Azote ammoniacal	Chlorures	Aluminium	BPC
Nitrites et nitrates	Fluorures	Arsenic	Dioxines et furanes chlorés
Phosphore	Sulfates	Baryum	Herbicides (2)
		Bore	HAP
		Chrome	Surfactants anioniques
		Cuivre	
		Fer	
		Mercure (1)	

(1) : Fréquence supérieure à 85 % avec les échantillons prélevés en 98-99 uniquement en raison de l'utilisation d'une méthode ayant une meilleure limite de détection.

(2) : Les pesticides (herbicides et insecticides) ont été analysés dans 42 échantillons prélevés à deux stations seulement. Seuls les herbicides 2,4-D et mécoprop ont été détectés dans plus de 85 % des échantillons.

Bien que ces substances soient pratiquement omniprésentes dans les eaux usées des 15 stations, elles ne se retrouvent pas nécessairement dans l'effluent en concentrations jugées toxiques ou nuisibles. Plusieurs ne présentent aucun dépassement des critères de qualité de l'eau (sulfates, baryum, bore et herbicides) ou présentent quelques dépassements ponctuels de faible amplitude (chlorures, fluorures, fer et HAP).

Parmi les pesticides recherchés pour leur utilisation en milieu urbain, sept ont été détectés à l'effluent des deux stations d'épuration où ces analyses ont été effectuées. Ce sont les herbicides 2,4-D, mécoprop et dicamba, trois herbicides présents dans les mélanges commerciaux utilisés pour le traitement des pelouses, ainsi que les insecticides diazinon, carbaryl, malathion et chlorpyrifos. D'autres pesticides utilisés en grande culture ont également été détectés. La détection de ces derniers dans les effluents municipaux est probablement attribuable au transport atmosphérique depuis la zone agricole ceinturant la région urbaine. En été, les concentrations de pesticides, et plus particulièrement celles d'herbicides, semblent augmenter lors d'événements pluvieux en raison du ruissellement urbain. Ces résultats sont corroborés par d'autres études effectuées en Ontario et aux États-Unis.

L'étude de l'amplitude des dépassements des critères de qualité pour la protection de la vie aquatique montre qu'il y a pour quelques substances des dépassements fréquents des critères de qualité dont certains atteignent de fortes amplitudes (> 10). C'est le cas notamment pour l'azote ammoniacal, le phosphore, le sulfure d'hydrogène, l'aluminium, l'argent, le chrome, le cuivre, deux insecticides (le diazinon et le chlorpyrifos) et plus particulièrement pour les surfactants. Dans ce dernier cas, partout où les surfactants non ioniques et anioniques ont été détectés, ils dépassaient les critères de qualité de l'eau, et les dépassements sont importants dans la majorité des cas. La présence de ces substances à de telles concentrations suggère que les eaux usées municipales présentent un potentiel toxique nuisible à long terme pour la vie aquatique et ce, plus particulièrement dans les cours d'eau qui n'auraient pas une grande capacité assimilatrice.

D'autres substances, reconnues pour être toxiques et hautement bioaccumulables, semblent être omniprésentes et ont été détectées à des concentrations significatives par rapport aux critères de qualité pour la prévention de la contamination des organismes aquatiques. C'est le cas pour les BPC et les dioxines et furanes chlorés, et dans une moindre mesure, pour le mercure. Ces substances peuvent contaminer la chair ou les tissus des poissons, mollusques et crustacés, les rendant impropres à une consommation sans restriction. Pour la faune terrestre piscivore, ces substances peuvent être plus dommageables puisque la quantité de poissons consommée par cette faune est plus élevée que celle consommée par les humains et qu'elle consomme les organismes en entier, incluant les tissus où la bioaccumulation est plus élevée que dans la chair.

Les sources de ces substances bioaccumulables dans les eaux usées municipales, BPC et dioxines et furanes chlorés plus particulièrement, sont multiples et complexes. Outre les rejets industriels, ces substances peuvent provenir de sources atmosphériques plus ou moins éloignées et contaminer les eaux de ruissellement urbain de même que les milieux aquatiques récepteurs desquels les municipalités puisent leur eau d'approvisionnement. Seules des études de bilan massique sur le réseau municipal permettraient de déterminer l'apport des différentes sources acheminées aux stations d'épuration.

POTENTIEL TOXIQUE POUR LA VIE AQUATIQUE SELON LES TESTS DE TOXICITÉ DE L'APPROCHE DE PROTECTION DU MILIEU AQUATIQUE DU MENV

Avec les tests de toxicité aiguë, il y a peu de dépassements du critère de toxicité globale de 1 UTa et ceux-ci sont de très faibles amplitudes dans la majorité des cas. Plus de la moitié des stations (53 %) n'ont obtenu aucun résultat supérieur à 1 UTa. 22 % des échantillons ont été toxiques pour la Truite arc-en-ciel et 11 % l'ont été pour *Daphnia magna*. À titre de comparaison, une étude ontarienne similaire réalisée en 1992 montre des pourcentages de 56 % et 27 % respectivement. Ces différences sont principalement liées au fait que les stations d'épuration du Québec n'appliquent pas un traitement au chlore pour désinfecter leurs eaux usées, contrairement à plusieurs stations en Ontario.

L'azote ammoniacal, à des concentrations supérieures à 10 mg/L, semble être le principal responsable de la toxicité aiguë mesurée. Les surfactants pourraient être le deuxième contaminant le plus généralisé alors que les nitrites sont à suspecter à une station. La présence de pesticides en été peut être une autre cause de toxicité.

Des effets de toxicité chronique ont été mesurés sur les effluents non dilués de presque toutes les stations, mais dans l'ensemble les dépassements du critère de toxicité globale de 1 UTc sont de faible amplitude (réponses de 1 à 2 UTc), ce qui suggère qu'il n'y aura pas ou peu d'effets sur le milieu une fois l'effluent mélangé dans le cours d'eau. Toutes saisons confondues, un peu plus du tiers des stations ont obtenu des résultats au-dessus de 10 UTc, ce qui confère à ces effluents le potentiel de nuire à la vie aquatique là où les cours d'eau ont une faible capacité assimilatrice. Une seule station a obtenu des résultats supérieurs à 30 UTc.

Presque tous les échantillons ont provoqué une stimulation de la croissance algale. Cette réponse positive chez l'algue *S. capricornutum* n'est pas quantifiée en terme d'unité toxique, mais indique tout de même un potentiel de nuisance pour la vie aquatique par le processus d'eutrophisation.

Les substances les plus susceptibles d'avoir contribué à la toxicité chronique mesurée sont l'azote ammoniacal, quelques métaux (cuivre, chrome et aluminium principalement), les surfactants et, de façon probable, certains pesticides dont le diazinon et le chlorpyrifos. Dans certains cas spécifiques, les nitrites, les cyanures ou le sulfure d'hydrogène ont pu jouer un rôle. Dans tous les cas, l'expression d'effets chroniques coïncide avec la présence simultanée de plusieurs substances à des concentrations supérieures aux seuils sécuritaires.

Seules des études d'identification de la toxicité permettraient de déterminer, au cas par cas, les substances responsables de la toxicité chronique et aiguë.

POTENTIEL TOXIQUE SELON LES TOXIMESURES DE L'INDICE BEEP

Aucun seuil ou critère n'a encore été fixé pour indiquer un niveau de préoccupation ou de nuisance en regard de la toximesure de l'indice BEEP (Barème d'effets écotoxiques potentiels).

Bien qu'il ne soit pas possible de conclure sur le potentiel toxique des effluents municipaux à l'égard des toximesures, cet outil permet de mieux définir la qualité des eaux usées et il s'est avéré utile dans l'interprétation des résultats.

Le test de génotoxicité a été particulièrement sensible aux eaux usées municipales puisque des réponses toxiques ont été observées à plus de deux stations sur trois. Ces résultats suggèrent que les effluents municipaux non dilués peuvent contenir des substances en concentrations capables d'altérer l'ADN bactérien.

INFLUENCE DES SAISONS, DU TYPE DE TRAITEMENT, DE LA CHARGE INDUSTRIELLE ET DE LA DÉPHOSPHATATION SUR LE POTENTIEL TOXIQUE

Les résultats de l'étude indiquent que le potentiel toxique des effluents des stations d'épuration municipales du Québec est variable d'une station à l'autre. Les effluents des étangs aérés caractérisés en conditions d'opération hivernales sont souvent toxiques aigus pour la Truite arc-en-ciel en raison de concentrations élevées d'azote ammoniacal. Les procédés de traitement sans équipement d'aération (étangs non aérés et procédés physico-chimiques) pourraient présenter un potentiel toxique plus élevé certaines périodes de l'année (durant la vidange de printemps pour les étangs non aérés et durant l'été pour le traitement physico-chimique) en raison de la production biologique de sulfure d'hydrogène en conditions anaérobies.

Les effluents des stations ayant une importante charge industrielle ont été, dans l'ensemble, plus toxiques que ceux des stations avec une faible charge industrielle. L'examen des résultats indique que l'apport industriel semble être un facteur déterminant du potentiel toxique des effluents municipaux, même si ceux-ci peuvent être toxiques sans apport industriel important.

En plus de l'enlèvement du phosphore, la déphosphatation chimique aurait un effet bénéfique sur l'enlèvement des métaux. Par contre, elle semble entraîner une augmentation de la concentration du métal utilisé comme coagulant. Bien que la déphosphatation chimique semble également avoir un effet bénéfique sur le potentiel toxique des effluents municipaux, il est impossible de conclure en toute certitude puisque les résultats des tests de toxicité obtenus ici sont dans l'ensemble beaucoup plus influencés par le type de traitement, les saisons et la charge industrielle que par la déphosphatation.

CONCLUSION À L'ÉGARD DES MÉTHODES D'ANALYSE ET D'ÉCHANTILLONNAGE UTILISÉES

L'utilisation de meilleures techniques analytiques a permis d'abaisser les limites de détection et ainsi d'obtenir un meilleur portrait de la qualité des eaux usées municipales, en plus d'obtenir des résultats comparables aux seuils sécuritaires définis (les critères de qualité de l'eau) pour plusieurs substances et métaux. Ces meilleures techniques ont aussi permis de mettre en évidence la présence de substances rarement quantifiées dans ce type d'effluents (par exemple les BPC et les dioxines et furanes chlorés).

Contrairement à d'autres études réalisées ailleurs, le ciblage des pesticides susceptibles de se retrouver en milieu urbain s'est avéré utile ici dans le choix de méthodes analytiques plus appropriées pour mettre en évidence leur présence dans les eaux usées municipales.

Les méthodes d'analyse par balayage des substances organiques semi-volatiles (SOBN) et volatiles (SOV) ont montré que dans le cas des effluents municipaux ces méthodes manquaient de spécificité et de résolution. Il y aurait avantage à cibler un nombre restreint de substances, par exemple uniquement la vingtaine de SOV faisant l'objet d'une accréditation des laboratoires.

Cette étude confirme encore une fois la nécessité d'utiliser plusieurs tests de toxicité afin d'évaluer adéquatement la toxicité d'un effluent en raison de la variabilité des contaminants présents dans les échantillons qui fait parfois réagir une espèce, parfois une autre.

CONCLUSION GÉNÉRALE

Les interventions en assainissement municipal réalisées au Québec depuis 1979 ont eu des effets positifs sur la qualité des cours d'eau. Les stations d'épuration construites dans le cadre de ces programmes d'assainissement ont été conçues de façon à réduire particulièrement les principaux contaminants des eaux usées municipales, soit les paramètres conventionnels (DBO_5, MES, phosphore et coliformes fécaux). Bien que ces stations puissent atteindre un certain rendement à l'égard de l'enlèvement des autres contaminants potentiellement présents dans les eaux usées municipales, elles ne peuvent les éliminer complètement.

Dans le cadre de cette étude, les effluents de 15 stations d'épuration municipales ont été caractérisés. Les résultats des tests de toxicité montrent que même si les eaux usées de presque toutes les stations étudiées présentent une toxicité après traitement, les effluents municipaux sont, à quelques exceptions près, peu toxiques pour les espèces testées.

La principale substance responsable de la toxicité mesurée semble être l'azote ammoniacal, à des concentrations supérieures à 10 mg/L. En saison froide, lorsque le processus de nitrification est réduit, les concentrations d'azote ammoniacal sont plus élevées, particulièrement dans les étangs aérés. Suivraient les surfactant anioniques, puis dans une moindre mesure, les surfactants non ioniques. Les surfactants sont des molécules organiques qui entrent dans la composition de centaines de produits utilisés, entre autres, comme agents nettoyants autant à des fins domestiques qu'industrielles. Enfin, d'autres substances, telles que certains pesticides et métaux, pourraient aussi être responsables de la toxicité mesurée.

Cette étude met en évidence l'omniprésence de plusieurs substances dans les eaux usées municipales de quinze stations d'épuration, dont certaines substances organiques rarement quantifiées dans d'autres études et se retrouvant à des concentrations pouvant détériorer des usages de l'eau. Il s'agit des surfactants, des BPC et des dioxines et furanes chlorés. Il en est de même pour certains pesticides en saison estivale lors d'événements de pluie. Toutefois, pour évaluer leur impact réel, il faudrait considérer les charges rejetées et détenir dans chacun des cas de bonnes connaissances des caractéristiques biophysiques et chimiques des milieux récepteurs respectifs.

L'importance de l'apport industriel aux stations d'épuration semble être un facteur déterminant du potentiel toxique des effluents municipaux, même si ceux-ci peuvent être toxiques sans apport industriel important.

RECOMMANDATIONS

Les stations d'épuration municipales qui respectent leurs exigences de rejet pourraient difficilement réduire davantage la toxicité de leurs effluents. L'ajout d'équipements pour accomplir cette tâche risque d'être coûteux et peu efficace compte tenu de l'importance des débits et de la dilution des contaminants. *Les efforts devraient plutôt être orientés vers la réduction à la source* où les interventions risquent d'être beaucoup plus économiques et efficaces, particulièrement en ce qui a trait aux contaminants de source industrielle. Dans cette optique, des efforts de sensibilisation adressés aux citoyens devraient également être envisagés pour réduire l'usage de certains contaminants utilisés dans une large mesure à des fins domestiques (pesticides et surfactants notamment).

Toutefois, *certains problèmes inhérents au type de traitement devront trouver d'autres avenues de solution afin de réduire la toxicité des effluents*. C'est le cas, par exemple, pour les étangs aérés avec des concentrations d'azote ammoniacal supérieures à 10 mg/L en hiver. Les critères de sélection des stations retenues ici excluaient celles ayant des concentrations élevées d'azote ammoniacal. Malgré cela, l'étude a pu établir un lien entre ce paramètre et la toxicité des effluents municipaux. Au Québec, plusieurs stations obtiennent des concentrations élevées d'azote ammoniacal. Sur l'ensemble des résultats compilés depuis 1995, 16 stations d'épuration municipales ont obtenu au moins un résultat supérieur à 50 mg/L d'azote ammoniacal et 27 stations ont obtenu une moyenne générale supérieure à 10 mg/L, ce qui représente 5 % des stations au Québec. Les concentrations les plus élevées sont généralement dues à la présence d'industries, surtout du secteur agroalimentaire. Dans ce dernier cas, la réduction à la source demeure une solution à privilégier.

Comme d'autres études l'ont fait auparavant, l'étude démontre que les stations d'épuration municipales peuvent être une source de contaminants à des seuils parfois toxiques ou nuisibles aux usages de l'eau. La présente étude ne permet cependant pas de juger de l'impact des effluents sur leur milieu récepteur respectif. Pour ce faire, *la fréquence d'échantillonnage d'une caractérisation complète des effluents doit être plus élevée pour en apprécier la variabilité et les résultats devraient être analysés à la lumière d'objectifs environnementaux de rejet (OER)*. Les OER sont basés sur les critères de qualité pour les différents usages de l'eau et ils tiennent compte de la spécificité de l'effluent (le débit notamment) et des caractéristiques des milieux récepteurs.

L'établissement d'OER pour l'ensemble des substances présentes à l'effluent et pour la toxicité globale mesurée à l'aide des tests de toxicité s'avère donc essentiel pour préciser au cas par cas les problèmes appréhendés dans un milieu précis et pour identifier les substances qui en sont responsables. Toutefois, *les effluents municipaux ne sont pas les seules sources de contamination des milieux récepteurs. Leur apport devrait être évalué en fonction des autres sources* telles que les débordements d'eaux usées non traitées via les ouvrages de surverses, les eaux de ruissellement urbain, la pollution d'origine agricole, les industries hors réseau d'égouts municipal, les retombées atmosphériques, les eaux de résurgence des terrains contaminés et des lieux d'enfouissement sanitaire.

Enfin, *des données de base sur la qualité de l'eau des milieux récepteurs sont aussi nécessaires dans cette démarche*. Pour la majorité des substances toxiques, les données actuelles sont partielles, voire inexistantes, pour la plupart des plans d'eau. *Le MENV devrait continuer à favoriser ce gain d'information et cibler en priorité les substances problématiques*.

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GLOSSARY

Acute toxicity – Toxicity that occurs within a short time period (seconds, minutes, hours or a few days) relative to the life expectancy of the test organism.

Bioaccumulation – The net accumulation of a substance in the tissues of an organism resulting from the exposure to different sources of contamination in the environment.

Biodegradation – Microbiological process (e.g. due to bacterial activity) that alters the chemical structure of a compound. It usually causes decomposition of organic molecules into smaller components. For example, biodegradation of hydrocarbons in aerobic conditions ultimately releases organic carbon (CO_2) and water (H_2O).

Biological characterization – Group of toxicity tests conducted to evaluate the ecotoxic potential of an experimental matrix (e.g. a sample of effluent from a wastewater treatment plant).

Chronic toxicity – Toxicity that occurs during a relatively long exposure period, corresponding to at least 10% of the organism's life cycle.

Composite sample – Reconstituted sample from the mixture of effluent sub-samples or from feed water collected at the sampling point of the treatment plant.

Discharge requirement – Specific limits defined by the MAMM (Quebec Municipal Affairs Ministry) and expressed in concentrations and loads to ensure optimal operation of each municipal wastewater treatment plant. The discharge requirements are defined for one or more of the following parameters: BOD_5, SM, P_T and/or fecal coliforms.

Environmental discharge objectives (EDOs) – Specific limits defined by the MENV, expressed in concentrations and loads. These environmental discharge objectives do not necessarily convert into discharge requirements because they take technological limitations into consideration. The environmental discharge objectives are based on quality criteria for different activities in water bodies. They also take into consideration the specificity of the effluent (flow rate, for one) and the characteristics of the receiving environment.

Ecotoxic effect – Toxic effect for one or many environmental components.

IC_{50} – Median inhibition concentration. The estimated concentration of the effluent (% v/v) that leads to 50% inhibition of a quantitative biological function (e.g. growth), with respect to the control organisms, after a given exposure period.

LC_{50} – Median lethal concentration. The concentration of the effluent (% v/v) that is considered lethal for 50% of the organisms subjected to the test. LC_{50} is derived by statistical analysis of deaths observed at different experimental concentrations after a given exposure period (e.g. 96 hours).

Lethal – That which results in the death of exposed organisms. For example, the death of trout is defined as the moment when signs of movement or activity cease to be observed.

LOEC – Lowest observed effect concentration. The lowest concentration of an experimental matrix that produces harmful effects on organisms exposed thereto. For example, the LOEC is the most reliable concentration to which the growth of algae exposed to the effluent sample differs significantly from the control organisms.

NOEC – No-observed effect concentration. The highest concentration of an experimental sample that produces no observed harmful effect on the organisms exposed thereto. The no-observed effect must also be statistically significant. For example, NOEC is the highest test concentration to which the growth of algae does not differ significantly from the control organisms.

Planar or coplanar PCB – PCB molecule that can adopt a planar configuration.

Quality control – Group of techniques and means to measure and assess the quality of data, and if required, corrective measures to apply when quality standards are not being met.

Sublethal – That which is harmful for the organism subjected to the test, but below the level that leads to death during a test.

TEC – Threshold effect concentration. The geometric mean of NOEC and LOEC.

Toxicity – Capacity specific to a substance or matrix (e.g. a sample of effluent from a wastewater treatment plant) to result in harmful effects to the organism exposed thereto.

Toxicity test – Laboratory test that allows for the determination of the effect of matter or of a matrix (e.g. a sample of effluent from a wastewater treatment plant) on a group of organisms from the same species (e.g. *Vibrio fischeri*), in well-defined conditions. A toxicity test is usually serves either to measure the proportion of organisms affected or to determine the intensity of the observed effect, after exposure to matter or to a given experimental matrix. Generally called a *bioassay* or *biological test*.

Toxic unit – Relative toxicity unit of an experimental sample; for an effluent, calculate as follows:

$$\text{Toxic unit} = \frac{100\,\%}{\text{toxicity result (ex.: } IC_{50} = x\ \%)}$$

SYMBOLS AND ABBREVIATIONS

<	result or mean concentration lower than the detection limit
*	result rejected relative to quality control
( )	(result shown in parentheses): result with a high level of uncertainty in relation to quality control; to be considered with caution
□	(blank box in results tables): indicates a parameter that was not measured
ß-gal	ß-galactosidase
µg	microgram (10^{-6} g)
µS	microSiemens
% v/v	volume percent
ACAL	acute water quality criterion for the protection of aquatic life
ATU.bvu^{-1}	adjusted toxic unit per bioanalytical volume unit
ATU.h^{-1}	adjusted toxic unit per hour
BOD$_5$	five-day biochemical oxygen demand
CBOD$_5$	five-day carbonated biochemical oxygen demand
CCAL	chronic water quality criterion for the protection of aquatic life
CPCO	water quality criterion for the prevention of contamination of aquatic organisms
CPPW	water quality criterion for the protection of piscivorous wildlife
CUM	Communauté urbaine de Montréal (Montreal Urban Community)
CUO	Communauté urbaine de l'Outaouais (Outaouais Urban Community)
CUQ	Communauté urbaine de Québec (Quebec Urban Community)
d	day
Df	dilution factor
DNA	desoxyribonucleic acid
EDO	environmental discharge objective
FAV	final acute value (= 2 x ACAL)
GU$_{CS}$	chronic sublethality genotoxic unit
IC$_{50}$	median inhibition concentration
LC$_{50}$	median lethal concentration
LD	limit of detection
< LIM	mean concentration lower than the detection limit
LOEC	lowest observed effect concentration
MAMM	ministère des Affaires municipales et de la Métropole du Québec (Quebec Municipal Affairs Ministry)
MENV	ministère de l'Environnement du Québec (Quebec Environment Ministry)
ng	nanogram (10^{-9} g)

nl	non-lethal
nm	nanometre
NOEC	no-observed effect concentration
ns	non-significant
nv	non-valid
PADEM	Programme d'assainissement des eaux municipales (Quebec Municipal Wastewater Abatement Program)
PAEQ	Programme d'assainissement des eaux du Québec (Quebec Wastewater Abatement Program)
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCP	physico-chemical parameter
PEEP	potential ecotoxic effects probe
pg	picogram (10^{-12} g)
P_T	total phosphorus
S9	microsomal fraction of rat liver
SLAP	St. Lawrence Action Plan
SLV 2000	St. Lawrence Vision 2000
SM	suspended matter
SVOC	semi-volatile organic substance
TEC	threshold effect concentration
TM	total metal
TRC	total residual chlorine
TUa	acute toxic unit
TU_{AS}	acute sublethality toxic unit
TUc	chronic toxic unit
TU_{CS}	chronic sublethality toxic unit
TU_L	lethal toxic unit
TU_S	sublethal toxic unit
VOC	volatile organic substance
Xgal	5-bromo-4-chloro-3-β-D-galactoside (X-gal)

1 INTRODUCTION

1.1 Background

Major financial and technical resources have been marshalled over the last 20 years to recover use of Quebec's watercourses. Some $7 billion was spent within the framework of two water cleanup programs: the *Programme d'Assainissement des Eaux du Québec* (PAEQ) and the *Programme d'Assainissement des Eaux Municipales du Québec* (PADEM). By virtue of these programs, 98% of the Quebec population that have existing sewer services were connected up to wastewater treatment plants. Observed trends and changes in contaminant loads over time suggest that the water cleanup activities[1] carried out between 1979 and 1998 have had positive effects on the water quality of Quebec rivers (Painchaud, 1997; Simard and Painchaud, 2000). Time series analyses of nitrite-nitrates, ammonia nitrogen, total phosphorus, turbidity and fecal coliforms reveal a preponderant downward trend. Improvement in water quality has been more noticeable during the last 10 years (1988-1998) than during the 1979-1994 period (Simard and Painchaud, 2000). Loads of biochemical oxygen demand (BOD_5) and suspended matter (SM) in municipal effluents are also diminishing.

Despite the improved quality of effluents released to watercourses in the wake of the PAEQ and PADEM programs, it is possible that certain municipal effluents are potentially toxic to some aquatic species. Municipal effluents may also contain persistent and bioaccumulable substances that can degrade the quality of body tissue in organisms exposed to them. These substances also increase the exposure sustained by fish-eating animals.

Studies and toxicity tests conducted throughout North America found that many municipal treatment plant effluents were toxic to the organisms observed — fish, shellfish and algae (Rutherford *et al.*, 1993; Orr *et al.*, 1992). Some effluents were highly toxic, causing the death of organisms within a short period of time (acute lethal toxicity), while others had more long-term effects (chronic toxicity).

In light of this information, and given the progress of the water cleanup programs, the Quebec Environment Ministry (MENV) decided, in 1993, to set up a committee mandated to determine the means by which to assess the toxic potential of effluents generated by municipal wastewater treatment plants in Quebec.

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[1] Activities carried out in the municipal, industrial and agricultural sectors.

1.2 Global Issue and Studies Carried Out by the Quebec Environment Ministry Committee

The toxicity of a municipal effluent may have several origins. For example, it may be due to contaminants in the effluent of the wastewater treatment plant not being sufficiently controlled by the treatment; substances, such as chlorine, that are added during treatment; changes in the physico-chemical characteristics of the water, such as the transformation of organic nitrogen into ammonia nitrogen, during treatment, or the combined effect of several contaminants simultaneously present in the effluent.

By virtue of the MISA program (Municipal and Industrial Strategy for Abatement), the Ontario Ministry of the Environment conducted several studies to assess the toxicity of municipal effluents. A sampling of 37 municipal treatment plants at first showed that within the range of contaminants analysed, metals were found most frequently and in significant concentrations relative to water quality criteria (Canviro Consultants, 1989).

In a second report, Beak and Canviro (1990) established that chlorine and ammonia nitrogen were major causes of the toxicity measured. Indeed, chlorine disinfection was identified as a source of toxicity for aquatic life. They also emphasized that primary treatment effluents, even without chlorine disinfection, were generally toxic. This was likely due to the presence of high concentrations of ammonia nitrogen and to insufficient removal of BOD_5. The secondary treatment effluents were sometimes toxic, particularly when concentrations of ammonia nitrogen exceeded 10 mg/L. This occurred mostly during winter, when nitrification is reduced. In the case of unaerated lagoons, hydrogen sulfide was identified as an additional cause of toxicity. According to the authors, other substances, such as metals, surfactants and some organic compounds, may also contribute to the toxicity of municipal effluents.

Following this report, the Ontario Ministry of the Environment conducted toxicity tests on the effluents of 10 municipal treatment plants (Orr *et al.*, 1992). Acute toxicity tests established that of the 123 water samples drawn, 56% were toxic (acute lethality) for rainbow trout (*Oncorhynchus mykiss*) and 27% were toxic (acute lethality) for the cladoceran *Daphnia magna*. Chlorine disinfection and high concentrations of ammonia nitrogen were identified as the main causes of this toxicity. Other toxicity tests were conducted on 80 samples selected and treated[2] to measure chronic toxicity: 69% of those samples caused a reduction in the growth of the fathead minnow (*Pimephales promelas*) and 56% of the samples affected the reproduction of the cladoceran *Ceriodaphnia dubia*. Other parameters, such as BOD_5, dissolved organic carbon, SM and metals also appeared to be related to the toxicity of some samples. In addition, hydrogen sulfide seemed to have contributed to the toxicity observed in the samples taken from unaerated lagoons. Finally, as for other studies, the Orr *et al.* study (1992) showed that the sensitivity of organisms to toxic substances found in the samples varies from one species to another, and that is why it is important to use several toxicity tests that are representative of various trophic levels.

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[2] The samples were dechlorinated and the pH was adjusted when high concentrations of chlorine and ammonia nitrogen were measured, in order to reduce toxicity due to those substances.

In the United States, a NPDES permit (National Pollutant Discharge Elimination System) is required to release wastewater into the environment. When renewing the licenses of municipal wastewater treatment plants, monitoring requirements are established and included in the license, such as toxicity tests and contaminant concentration levels to be respected. When toxicity tests demonstrate that an effluent is toxic, identification and toxicity reduction procedures are established (*toxicity identification evaluation* – TIE and *toxicity reduction evaluation* – TRE).

In Canada, all wastewater treatment plant effluents are subject to Section 36(3) of the *Fisheries Act*. This provision prohibits the disposal of harmful substances in any water frequented by fish. Under this law, the Minister of Fisheries and Oceans has the power to authorize exceptions to the general prohibition, by means of regulations. Such power has not been exercised in relation to the discharge of municipal wastewater.

The problem of effluent toxicity in Quebec is not well understood, as few toxicity tests have yet been conducted. However, the situation in Quebec is different from that of Ontario or the United States, due to the fact that chlorine disinfection of wastewater is almost non-existent. The toxicity of chlorine being recognized when Quebec introduced its cleanup program, other systems, such as ultraviolet disinfection, were preferred.

In addition, in Quebec, industrial facilities that are connected to a municipal sewer system must comply with the discharge standards of the municipal by-laws in effect. Most municipalities have adopted such by-laws. However, the prescribed concentrations do not ensure that discharges will be free of toxic substances once treated. The toxicity of the effluent at the end of the treatment process would therefore depend on the composition of the wastewaters going into the treatment plant and on the performance of the treatment system. It must also be said that municipal by-laws do not cover all potential contaminants.

Following an analysis of the situation, the committee created by the MENV produced a report in February 1994 (Tétreault *et al.*, 1994). In this report, the committee concluded that very few treatment plants in Quebec generated any toxicity due to chlorine disinfection[3]. On the other hand, of the 160 plants for which data was available in 1991–92, 61 plants (38%) showed at least one downstream sampling result containing more than 20 mg/L of ammonia nitrogen. For the committee, these plants — particularly those with aerated lagoons where the nitrification process is reduced in winter — presented a high toxicity risk. To this list may be added the few unaerated lagoons with continuous winter flow, since they may contain high concentrations of hydrogen sulfide.

The committee recommended a characterization campaign, including physico-chemical analyses and toxicity tests, to assess the toxic potential of municipal effluents. It recommended a campaign covering 15 municipal treatment plants, selected for their representativeness in terms of all treatment processes and various operating conditions (i.e. with/without chemical dephosphatization, with/without major industrial inputs) employed in Quebec. Plants using chlorine disinfection and those with very high concentrations of ammonia nitrogen were excluded. The toxicity of these effluents having been established in Ontario and elsewhere, there was limited use in confirming this recognized fact. For the same reason, continuous discharges from unaerated lagoons in winter were also excluded. The committee finally recommended that the campaign be carried out over two different periods, covering winter and summer operating conditions.

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[3] At the time of the report, in 1994, there were two treatment plants in Quebec still using chlorine disinfection and both were planning to convert to an ultraviolet disinfection system. One converted in 1996 while the other did so in 2000.

1.3 Objectives of the Study

The primary objective of the study was to assess the toxic potential of Quebec municipal treatment plant discharges and, more specifically:

- assess acute (i.e. short term) and chronic (i.e. long term) end-of-pipe toxicity of effluents for aquatic life;
- assess the toxic potential for humans and wildlife due to the presence of substances that can degrade the quality of body tissue in aquatic organisms.

However, in order to obtain a complete and coherent analysis with regard to our main objective, several underlying objectives were added to target, when applicable, the causes of toxicity in municipal effluents:

- identify the possible relation between measured toxicity and the substances detected in municipal effluents;
- identify the possible relation between measured toxicity and the type of treatment process;
- determine whether the performance of treatment processes in winter and in summer has an effect on the toxic pattern of municipal effluents;
- verify the influence of industrial inputs on measured toxicity;
- assess the impact of chemical dephosphatization on measured toxicity.

1.4 Implementation of the Characterization Campaign and Approach for Assessing Toxic Potential

The project for assessing the toxic potential of municipal effluents was divided into two characterization campaigns: 1) one campaign carried out in 1996–97, and mainly constituted of characterizations of plants under winter operating conditions; 2) then a second one in 1998–99, mainly conducted under summer conditions.

In 1996, the project was incorporated into the programming of the *St. Lawrence Vision 2000* Action Plan (SLV 2000). The *Protection* component had the responsibility of carrying out the first campaign in 1996–97. In June 1998, a new Quebec-Canada harmonization agreement was signed regarding *SLV 2000 Phase III* and the 1998–99 campaign was part of the *Industrial and Urban* component.

The sampling work, along with several physico-chemical analyses and some toxicity tests, was carried out by private firms. The St. Lawrence Centre carried out several toxicity tests and assessed the quality of the results of the physico-chemical analyses and toxicity tests conducted by private labs. Many organic analyses were carried out at the *Centre d'expertise en analyse environnementale du Québec* (CEAEQ) (Quebec Centre of Expertise in Environmental Analysis). The CEAEQ also took on the task of analysing metals and pesticides during the 1998 and 1999 characterization campaigns.

In order to obtain a representative overview of treatment plants in Quebec, the approach advanced to assess the toxic potential of municipal plant effluents is the following:

- The characterization campaign results (toxicity tests and physico-chemical analyses) are first compared with potential effect thresholds represented by the surface water quality criteria (MEF, 1998). This process allows for an assessment of the potential end-of-pipe toxicity of municipal wastewater discharges. However, to evaluate the expected impact of an effluent on its environment, the nature of the discharges and the characteristics of the receiving aquatic environment must be taken into consideration. This approach, which consists of establishing specific limits for each effluent, by taking into consideration water quality criteria and conditions in the receiving aquatic environment (use of the water, concentration of substances upstream from the effluent, dilution of the effluent under critical conditions, etc.), is not presented in this study, however[4]. Only water quality criteria are used as indicators to analyse overall municipal effluents, that is:
  - to assess the potential toxicity of municipal treatment plant effluents without taking into account the sensitivity of the receiving environment;
  - to highlight the substances that are sensitive sources of the measured toxicity;
  - and to identify the common causes of toxicity.

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[4] The method used to calculate these limits, or environmental discharge objectives (EDOs), is described in the MENV document (1991, rev.1996).

- "Toxic prints", which are a component of the PEEP Index, are also compiled. This tool is used in the SLV 2000 Program to estimate the relative potential ecotoxic effects of effluents.

2 MATERIALS AND METHODS

2.1 Selection of Treatment Plants

The MENV committee report (Tétreault *et al.*, 1994) was the basis for the selection of the treatment plants. The selection criteria proposed in their report served for the purposes of this study. They aimed to identify plants that were representative of:

- all the main treatment processes existing in Quebec;
- plants having major industrial-source loads and others with minor inputs;
- plants that use dephosphatization (phosphate removal by chemical addition) and others that do not.

In addition, the plant selection criteria also had to take into account the following operating parameters in order for the toxicity to be measured under normal plant operating conditions:

- mean flow between 70 and 110% of design flow;
- BOD_5 upstream between 60 and 150% of the design load;
- effluent that meets discharge requirements for BOD_5 and SM;
- industrial fraction of BOD_5 upstream lower than 10% (low industrial input) or higher than 50% (major industrial input) of total BOD_5 [5];
- concentration of ammonia nitrogen upstream lower than 10 mg/L in summer and lower than 20 mg/L in winter;
- normal operation of the plant for several years without recent major modification of equipment or operating conditions;
- no chlorine disinfection.

The 20 mg/L ammonia nitrogen limit in winter may seem high compared to the results of the MISA program, which showed that concentrations greater than 10 mg/L could be toxic (Beak and Canviro, 1990; Orr *et al.*, 1992). This limit was maintained because, in Quebec, concentrations in aerated lagoons are frequently close to 20 mg/L in winter. Plants with aerated lagoons that exceed this limit, however, are considered isolated cases.

Available data at the MAMM and MENV at the time this project was initiated was used to evaluate the characteristics of treatment plants. These include treatment process type, the characteristics of the water at the inlet and at the outlet of the plant, the theoretical industrial input, and the use of chemical dephosphatization. Other aspects such as the size of the plant (number of persons served) or logistical aspects such as proximity to a large city or to sampling firms were taken into consideration in the final selection of the plants. Table 2.1 presents the final list of plants selected.

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[5] The size of the input or of the industrial load in this document refers to the industrial load proportion in the total load in BOD_5, in accordance with criteria listed here.

TABLE 2.1: TREATMENT PLANTS SELECTED

Process	Treatment plant			
	Low industrial inputs		**High industrial inputs**	
	With dephosphatization	**Without dephosphatization**	**With dephosphatization**	**Without dephosphatization**
Activated sludge:				
- conventional	CUO	---	---	---
- prolonged aeration	---	Jonquière	Farnham (1)	La Prairie (located in Sainte-Catherine)
- with filtration	---	---	Magog	---
Aerated lagoon	Sawyerville (1)	Saint-Gédéon (located in Lac Saint-Jean region)	Warwick (1) and Saint-Joseph-de-Beauce (1)	Cookshire
Biofiltration	Châteauguay (1)	CUQ (East plant)	---	---
Physico-chemical	Longueuil (Centre d'épuration Rive-Sud)	---	CUM	---
Unaerated lagoon	Martinville (2)	---	---	---

(1): Dephosphatization in summer only.
(2): Dephosphatization during spring lagoon emptying only.

This list of 15 plants provides a representative overview of the situation in Quebec, even though it does not cover all categories. The four main treatment processes are represented. They are the "activated sludge", "aerated lagoon", "biofiltration" and "physico-chemical" processes. In 1994, those processes represented, respectively, 12.5%, 13.7%, 10.9% and 62.5%, for a total of 99.6%, of the volume of municipal wastewater treated in Quebec. One plant with unaerated lagoons (Martinville) was also selected for sampling during fall and spring emptying. This corresponds respectively, in this project, to summer operating conditions (wastewater collected throughout summer and then emptied in the fall) and also to winter operating conditions (wastewater collected throughout winter and then emptied in the spring). Plants with unaerated lagoons represented 0.2% of the volume of treated municipal wastewater. Other processes, such as rotating biological filters, represented only 0.2% of the volume of municipal wastewater treated in Quebec in 1994.

Despite the selection criterion which eliminated plants with concentrations of ammonia nitrogen greater than 20 mg/L in winter, the Saint-Joseph-de-Beauce plant was added to include at least one case of an effluent with levels exceeding this criterion.

The Magog plant was also chosen because of the addition of chlorine before tertiary filtration occurs, to prevent biological clogging of the filters. It was deemed appropriate to verify the impact of this practice, in spite of the selection criterion concerning chlorine disinfection.

In the "with dephosphatization" category, six of the plants only use chemical dephosphatization during the summer season, as is the case generally in Quebec. Only the CUO, Longueuil (CERS), Magog and CUM plants use this process on a year-round basis, because their effluents are discharged in eutrophication-sensitive environments, such as lakes or reservoirs. This study thus includes four plants using dephosphatization on a year-round basis, six plants using dephosphatization only in the summer (including Martinville during spring emptying), and five plants which do no dephosphatization at all.

Appendix 1 presents some of the design and technical operating data on the treatment plants selected. Some plants do not comply completely with the overall selection criteria, but they still meet the objectives of the project. In the case of the CUM, the proportion of industrial input is unknown and probably does not meet the criterion of industrial BOD_5 being greater than 50% of the total BOD_5. However, given the great diversity of industrial plants and the existence of several service companies operating in various fields of activity in CUM territory, it is likely that a very diverse array of chemical substances will be present at the inlet of this treatment plant. Industrial input is thus considered significant, but its proportion cannot be accurately assessed.

2.2 Scheduling the Characterization Campaigns

The characterization campaigns at the municipal treatment plants were implemented based on the approach developed within the St. Lawrence Vision 2000 (SLV 2000) Program as part of its industrial characterization activities. The *Guide général de caractérisation SLV 2000* (general guide for characterization), published in April 1995, was used to draw up the specifications. Sampling firms that had pre-qualified for industrial characterizations were requested to bid according to the requirements contained in the Guide.

The campaigns were carried out over two time periods: 1996–97 and 1998–99. The 1996–97 campaign consisted of two phases, a pre-test in the fall of 1996 and characterization during the winter of 1996–97.

The first phase, the so-called "pre-test", served as a test campaign in preparation for the characterizations which would be conducted in winter 1996–97. This phase provided the means to validate the specifications and adjust them to the context of municipal plants. It was also used to ensure the respect of quality control requirements for field activities and analyses. The pre-test consisted of the characterization of two treatment plants under summer conditions: Sawyerville (September 1996) and Martinville during the fall lagoon emptying process (October 1996).

In the second phase, 14 treatment plants were sampled (all except Martinville) under winter operating conditions between December 1996 and February 1997.

Following the 1996–97 campaign the results were compiled and a status report was published in July 1998 (MENV and Environment Canada, 1998). The partial winter results were examined to adjust and improve the characterization program in preparation for the remainder of the project, by trying certain other analysis methods, and by adding several analyses, particularly for metals and some organic parameters.

The 1998–99 campaign was carried out between September 1998 and July 1999. In all, 12 plants were sampled, two of them twice (CUM and Longueuil). Of these 12 plants, 11 were sampled under summer conditions and one under winter conditions (Martinville in May 1999 during spring lagoon emptying). The three plants not visited were Sawyerville (already characterized in summer conditions during the pre-test phase), Magog and Warwick. These last two plants, which should have been sampled in summer, were eliminated to make room for more advanced analyses at other plants. The CUM and Longueuil plants were characterized twice in summer due to an error which occurred on certain samples drawn in the summer of 1998 during the toxicity test with *P. promelas*. Consequently, a second sampling was conducted in June 1999 to repeat the toxicity test and other analyses.

Table 2.2 presents a summary of the sampling program of the two characterization campaigns and Section 2.4 presents the analytical differences between the 1996–97 and the 1998–99 campaigns.

During the summer of 1999, the presence of certain pesticides in municipal effluents was also tested for. Because of the high cost of pesticide analysis and because of their seasonal and episodic use, it was decided to carry out intensive sampling at only two plants instead of sporadic sampling at all the plants. The two plants thus selected were the CUM and Longueuil plants, because of the size of the urban areas in question, the large proportion of combined sewer systems, and the availability of personnel and equipment to carry out the sampling.

Specialized lawn treatment firms usually apply pesticides in three stages. A first treatment during the summer, in May or June (when weeds first appear), a second herbicide treatment towards the end of July or the beginning of August, sometimes coupled with an insecticide treatment, and a final treatment in the fall, at the end of August, beginning of September. Obviously, treatments are also carried out by individuals who do not call in specialized firms. Sampling was thus performed more specifically to target the two first application stages.

TABLE 2.2: SAMPLING PROGRAM FOR THE CHARACTERIZATION CAMPAIGNS

Treatment plant	Winter operating conditions	Summer operating conditions
Châteauguay	January 21, 23 and 25, 1997	June 15, 17 and 19, 1999
CUM	December 10, 12 and 14, 1996	September 29, October 1 and 3, 1998 and June 8, 10 and 12, 1999
CUO	January 7, 9 and 11, 1997	July 6, 8 and 10, 1999
CUQ (East plant)	January 6, 8 and 10, 1997	July 6, 8 and 10, 1999
Cookshire	February 3, 5 and 7, 1997	July 13, 15 and 17, 1999
Farnham	February 11, 13 and 15, 1997	July 13, 15 and 17, 1999
Jonquière	January 20, 22 and 24, 1997	September 15, 17 and 19, 1998
La Prairie	December 3, 5 and 7, 1996	June 15, 17 and 19, 1999
Longueuil	December 10, 12 and 14, 1996	September 29, October 1 and 3, 1998 and June 8, 10 and 12, 1999
Magog	January 14, 16 and 18, 1997	Not characterized
Martinville	May 31, June 2 and 4, 1999	October 24, 28, 30 and November 1, 1996
Saint-Gédéon	January 20, 22 and 24, 1997	September 15, 17 and 19, 1998
Saint-Joseph-de-Beauce	January 27, 29 and 31, 1997	September 21, 23 and 25, 1998
Sawyerville	February 3, 5 and 7, 1997	September 23, 25 and 27, 1996
Warwick	January 27, 29 and 31, 1997	Not characterized
Number of treatment plants	15 treatment plants	13 treatment plants (CUM and Longueuil twice each)
Number of characterizations	14 characterizations in the winter of 1996–97 1 characterization in spring 1999	2 characterizations in 1996 (pre-test) 5 characterizations in summer 1998 8 characterizations in summer 1999

2.3 Toxicity Tests

The results of the toxicity tests carried out in winter and summer at all 15 municipal treatment plants were the subject of a specific report. Consequently, this section is a summary of previously published information. For further details on test methods, processing of the data or the specific results of each toxicity test, consult one of the 30 scientific and technical biological characterization reports published on the treatment plants by Environment Canada's St. Lawrence Centre (Bombardier, M.; Harwood, M., 1996 to 1999).

2.3.1 Selection of toxicity tests

A series of seven toxicity tests were retained for the study. The tests were essentially selected to meet the standard of the MENV (MEF, 1998) and to provide for the calculation of the toxic print component of the PEEP Index developed by Environment Canada (Costan *et al.*, 1993). Table 2.3 presents the list of toxicity tests selected and a few descriptive characteristics.

TABLE 2.3: SELECTED TOXICITY TESTS AND DESCRIPTIVE CHARACTERISTICS

Organism	Species	Trophic level	Toxicity level	Variable of effect
Marine bacteria	*Vibrio fischeri* (1) (Microtox™)	Decomposer	Acute sublethality	Inhibition of luminescence
Bacteria	*Escherichia coli* PQ37 (SOS Chromotest)	Decomposer	Chronic sublethality	Genotoxicity and cell viability
Algae	*Selenastrum capricornutum*	Primary producer	Chronic sublethality	Inhibition of cell division
Cladocerans (crustaceans)	*Ceriodaphnia dubia*	Primary consumer	Chronic lethality and sublethality	Mortality and reproductive inhibition
Cladocerans (crustaceans)	*Daphnia magna*	Primary consumer	Acute lethality	Mortality
Fish larvae	*Pimephales promelas* (Fathead minnow)	Secondary consumer	Chronic lethality and sublethality	Mortality and growth inhibition
Fish	*Oncorhynchus mykiss* (Rainbow trout)	Secondary consumer	Acute lethality	Mortality

(1): Species previously known as *Photobacterium phosphoreum*.

In Quebec, within the framework of the *Programme de réduction des rejets industriels* (PRRI) (industrial wastewater abatement program) and as part of the process of evaluating and examining the impact of new industrial plants, a series of criteria were established for the selection of toxicity tests aimed at assessing effluent toxicity.

Based on these criteria, the MENV had selected five tests to measure the toxicity of industrial effluents (MENVIQ, 1990, rev. 1992). To measure acute toxicity, lethality tests using rainbow trout (*Oncorhynchus mykiss*), fathead minnow (*Pimephales promelas*) and the cladoceran *Daphnia magna* were retained. To measure chronic toxicity, growth inhibition tests using fathead minnow larvae and the alga *Selenastrum capricornutum* were selected.

These tests, with the exception of the acute lethality test using *P. promelas*, were all chosen for this assessment of municipal effluents. On the other hand, anticipating that the alga chronic toxicity test would not be very sensitive to municipal effluents (Rutherford *et al.*, 1993), the inhibition test on the reproduction and survival of the cladoceran *Ceriodaphnia dubia* was added to evaluate the sublethal toxicity of the effluents.

In addition, in order to complete the tests required to calculate the PEEP Index toxic print component, the inhibition of luminescence test on the bacteria *Vibrio fischeri* (Microtox^{TM}) and the (geno) toxicity test[6] SOS Chromotest on the *Escherichia coli* PQ37 were added.

2.3.2 Sampling methods

Samples were collected and transported to the labs by specialized contracting firms in accordance with the requirements of the SLV 2000 general characterization guide (SLV 2000, 1995).

Samples of mechanical treatment plant effluents (activated sludge, biofiltration and physico-chemical treatments) were collected using portable automatic samplers. These devices collect a given volume of water at fixed intervals, providing for a representative 24-hour sample. In the case of aerated and unaerated lagoons, spot samples of the effluent were drawn. This approach is acceptable for such process types because of the low variation in water quality over time.

For each of these characterizations, toxicity tests were conducted on three samples drawn over three inconsecutive days (days 1, 3 and 5). A total volume of approximately 240 L (divided into four 60-L containers) was collected on each sampling day. All the wastewater samples were delivered the same day to the St. Lawrence Centre lab to be prepared, processed and subdivided.

2.3.3 Preparation and subdivision of samples

As soon as they were received, the samples drawn the same day and contained in the four 60-L containers were mixed together in the lab. A summary physico-chemical characterization of each sample was carried out immediately thereafter (see Section 2.3.4.1). Samples were then subdivided in preparation for the various toxicity tests. In addition, a 30-L portion of each daily sample (days 1, 3 or 5) was set aside to obtain a composite sample of 90 L (combination of samples from all three days). Figures 2.1 and 2.2 respectively illustrate the method generally used to prepare and subdivide the daily samples and the composite sample.

The acute toxicity tests (*D. magna* and *O. mykiss*) were carried out using each daily sample, except for the test with *V. fischeri*, which was carried out with the composite sample. The chronic toxicity tests (*E. coli* PQ 37, *S. capricornutum, C. dubia* and *P. promelas*) were carried out using the composite sample and/or the daily samples. In the latter case, the day 1 sample was used to start the testing, while the day 3 and 5 samples allowed for the water to be renewed respectively on the third and fifth day of testing with *C. dubia* and *P. promelas*.

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[6] Test used to detect the presence of substances that can cause primary lesions to bacterial DNA and reduce cell viability (Quillardet *et al.*, 1982).

Although there were slight differences between the 1996–97 and 1998–99 campaigns, samples were generally processed and subdivided as follows (Figure 2.1). In the case of daily samples, 2-L and 20-L aliquot portions were extracted from each sample (day 1, 3 and 5) then transferred into opaque white plastic buckets and stored at 4°C until their transport to the contract labs for toxicity testing with *D. magna*, *C. dubia* and *P. promelas*. The residual sampling volume, also placed in opaque white plastic buckets and stored at 4°C, was used to carry out tests with *O. mykiss*.

From the composite sample (Figure 2.2), a volume of 10 L was extracted and stored at 4°C until its delivery to the contract lab for toxicity testing with *C. dubia*. An aliquot portion of 1 L was filtered at 0.2 µm (polycarbonate, Nuclepore^{TM}) and stored at 4°C to be used in the toxicity tests with microorganisms (*V. fischeri*, *E. coli* PQ 37 and *S. capricornutum*). Finally, an aliquot portion of 10 L was aerated, and a 1-L sub-sample was filtered and subjected to the same toxicity tests as the unaerated portion, in order to assess the persistence of or changes in toxicity. The aerating method consists of having a constant air flow through (approximately 5 cm^3 per minute per litre of sample [$\approx 5\ mL/(min.L^{-1})$]), at room temperature (20 ± 2°C), for five days. Opaque white plastic buckets served as containers for the tests.

FIGURE 2.1: IN-LAB PREPARATION AND DIVISION OF DAILY SAMPLES (DAYS 1, 3 AND 5)

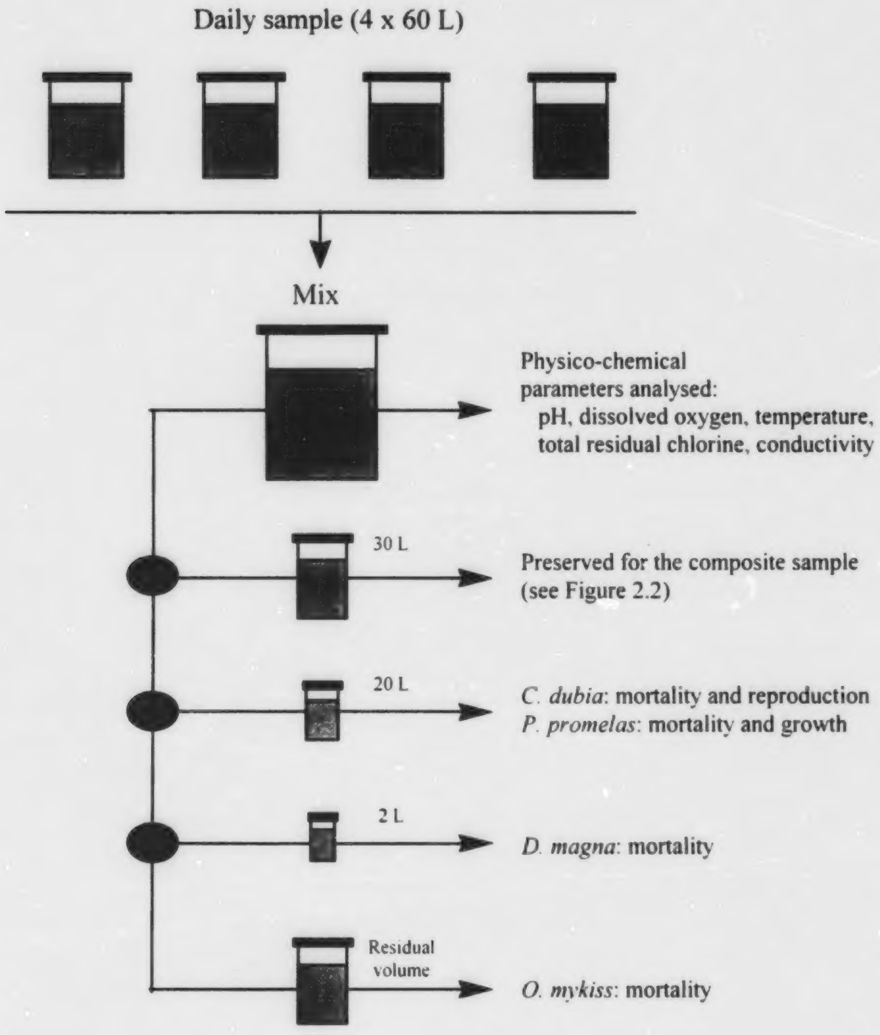
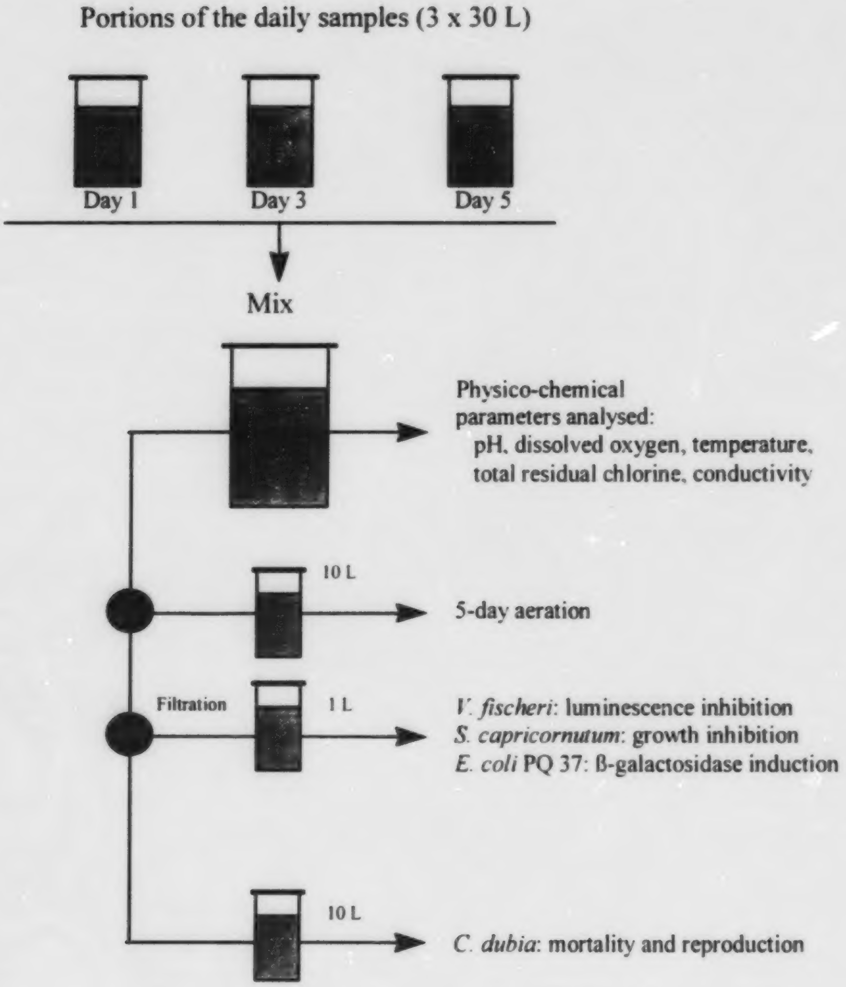

Daily sample (4 x 60 L)
Mix
Physico-chemical parameters analysed: pH, dissolved oxygen, temperature, total residual chlorine, conductivity
30 L
Preserved for the composite sample (see Figure 2.2)
20 L
C. dubia: mortality and reproduction
P. promelas: mortality and growth
2 L
D. magna: mortality
Residual volume
O. mykiss: mortality

FIGURE 2.2: IN-LAB PREPARATION AND DIVISION OF COMPOSITE SAMPLE


Portions of the daily samples (3 x 30 L)
Day 1
Day 3
Day 5
Mix
Physico-chemical
parameters analysed:
pH, dissolved oxygen, temperature,
total residual chlorine, conductivity
10 L
5-day aeration
Filtration
1 L
V. fischeri: luminescence inhibition
S. capricornutum: growth inhibition
E. coli PQ 37: ß-galactosidase induction
10 L
C. dubia: mortality and reproduction

2.3.4 Toxicity test methods

All toxicity tests with microorganisms (*V. fisheri*, *E. coli* PQ 37, *S. capricornutum*) were carried out at the St. Lawrence Centre lab. The rainbow trout (*O. mykiss*) tests were carried out at the St. Lawrence Centre lab for the samples drawn in 1996–97 and 1998, while the tests on samples drawn during the summer of 1999 were carried out at the *Laboratoire de l'environnement LCQ* (Sainte-Foy, Quebec). Tests on fathead minnow larvae (*P. promelas*) and cladocerans (*D. magna* and *C. dubia*) were performed by various contract labs, namely, B.A.R. Environmental Inc. (Guelph, Ontario), Laboratoires Bodycote Technitrol (Pointe-Claire, Quebec) or *Laboratoire de l'environnement LCQ* (Sainte-Foy, Quebec). The test protocols followed are presented in Table 2.4.

Appendix 4 provides a more detailed description of the toxicity test methods employed.

TABLE 2.4: TOXICITY TEST PROTOCOLS

Toxicity test	**Protocol**	**Reference**
Vibrio fischeri (Microtox™)	Environment Canada standard method (1992a) with few modifications	Environment Canada (1995)
Escherichia coli PQ 37 (SOS Chromotest)	St. Lawrence Centre Laboratory method	Environment Canada (1993)
Selenastrum capricornutum	Environment Canada standard method (96 wells microplate)	Environment Canada (1992b)
Ceriodaphnia dubia	Environment Canada standard method	Environment Canada (1992c)
Daphnia magna	Environment Canada standard method	Environment Canada (1990a; 1990b)
Pimephales promelas (Fathead minnow)	Environment Canada standard method	Environment Canada (1992d)
Oncorhynchus mykiss (Rainbow trout)	Environment Canada standard method	Environment Canada (1990c; 1990d)

2.3.4.1 *Physico-chemical parameters supporting the toxicity tests*

A series of physico-chemical analyses were usually carried out on the daily and composite samples to ensure sample quality and to obtain complementary information to support the toxicity tests when the results are interpreted.

The temperature, pH (before and after filtration), dissolved oxygen, conductivity and total residual chlorine (TRC) were measured on all samples according to standard methods (APHA, AWWA and WEF, 1995). In the case of the composite sample, pH was measured before and after aeration. In addition, the total organic carbon (TOC) concentration in the unaerated portion of the composite sample was determined at the beginning and at the end of the test using the persulfate oxidation method (APHA, AWWA and WEF, 1995) in order to assess the biodegradability of the effluents.

2.3.5 Quality control

Stringent quality control procedures were applied throughout the toxicity testing, as described in the *Guide de caractérisation des eaux usées industrielles* (Environment Canada, 1996d) (guide for the characterization of industrial wastewater).

2.4 Physico-chemical Analyses

Up to 26 conventional physico-chemical parameters, 19 metals and 8 families of chlorinated and unchlorinated organic parameters were measured in the effluents of the 15 treatment plants selected for this project. The list of parameters analysed is presented in Table 2.5.

2.4.1 Selection of the conventional physico-chemical parameters

During the first campaign in 1996–97, the group of conventional physico-chemical parameters (PCPs) to be analysed, defined in the SLV 2000 general characterization guide (SLV 2000, 1995), were chosen. These include parameters identified as conventional, as well as certain major ions and oils and greases. Only the measurement of carbonated BOD_5 was added at all plants. Since chlorine is added to the treatment process at the Magog plant, total residual chlorine was also analysed at this plant.

For the 1998–99 campaign, adjustments were made to the PCPs characterization profile. Some parameters for which no water quality criteria exist were eliminated (total solids, TOC and cyanates, for example) while others were added, particularly those parameters providing a better interpretation of the results with regard to water quality criteria (conductivity, hardness and dissolved sulfides).

TABLE 2.5: LIST OF PARAMETERS ANALYSED AT MUNICIPAL TREATMENT PLANTS

Parameter			**Campaign**		**Analytical scope (in number of treatment plants)**	
			1996-97	**1998-99**	**Winter**	**Summer**
Physico-chemical parameters (PCPs):					15	13
• *Conventional parameters:*						
pH, dissolved oxygen (DO) and temperature (1)			√	√		
Five-day biochemical oxygen demand (BOD_5)			√	√		
Carbonated BOD ($CBOD_5$)			√	√		
Chemical oxygen demand (COD)			√	√		
Suspended matter (SM)			√	√		
Total organic carbon (TOC)	Total solids (TS)		√			
Conductivity	Total hardness (in $CaCO_3$)			√		
• *Nutrients:*						
Ammonia nitrogen (NH_3- NH_4^+)	Total Kjeldahl nitrogen (N-TKN)		√	√		
Nitrites-nitrates (NO_2-NO_3)	Nitrites (NO_2)		√	√		
Total phosphorus (P_T)			√	√		
• *Major ions:*						
Chlorides (Cl^-)	Total fluorides (F^-)		√	√		
Sulfates (SO_4^{2-})	Total sulfides ($S^{2-}{}_T$)		√	√		
Total cyanides (CN^-)			√	√		
Total residual chlorine (TRC)	Cyanates (CNO^-)		√			
Dissolved sulfides ($S^{2-}{}_D$)				√		
• *Other parameters:*						
Phenolic substances (2)			√	√		
Total hydrocarbons (mineral oils and greases)			√	√		
Freon extractibles (total oils and greases)			√			
Metals:					15	13
Aluminum (Al)	Copper (Cu)	Lead (Pb)	√	√		
Silver (Ag)	Iron (Fe)	Selenium (Se)	√	√		
Cadmium (Cd)	Mercury (Hg)	Zinc (Zn)	√	√		
Chromium (Cr)	Nickel (Ni)		√	√		
Antimony (Sb)	Beryllium (Be)	Molybdenum (Mo)		√		
Arsenic (As)	Boron (B)	Vanadium (V)		√		
Barium (Ba)	Cobalt (Co)			√		
Semi-volatile organic substances (SVOCs):					2	11
Scan of over 50 organic compounds			√	√		
Volatile organic substances (VOCs):					7	11
Scan of over 40 organic compounds			√	√		
Nonionic and anionic surfactants			√	√	6	12
Polychlorinated biphenyls (PCBs):					7	11
43 specific congeners			√	√		
Homologues (± 200 congeners)			√	√		
Polycyclic aromatic hydrocarbons (PAHs):					6	11
22 specific PAHs (50 PAHs in 1999)			√	√		
Chlorinated dioxins and furans:					4	11
17 specific congeners			√	√		
Homologues			√	√		
Pesticides:						2
32 organophosphorus and other pesticides (triazines, carbamates, etc.)				√		
14 phenoxyacid herbicides				√		

(1): pH, dissolved oxygen and temperature were measured on site during sampling.

(2): Phenolic substances were analysed by scanning methods at 8 plants in 1996–97 and by colorimetry at 11 plants in 1998–99.

Most of the selected parameters constitute the main contaminants of domestic wastewater. Consequently, they also provide the means to evaluate the performance of a municipal treatment plant. In addition, historical data exist for some of these parameters since they are subject to regular monitoring by the operators of the treatment plants (ammonia nitrogen, BOD_5, SM, and phosphorus).

2.4.2 Selection of metals

For the 1996–97 campaign, the SLV 2000 general characterization guide's (SLV 2000, 1995) list of 11 metals was adopted for purposes of our analysis. These metals are those that are generally cited in the literature and they are present in significant concentrations in municipal effluents relative to water quality criteria (U.S. EPA, 1981; McDonald, 1989; Orr *et al.*, 1992; U.S. GAO, 1991; World Wildlife Fund, 1995). However, when the usual analysis methods were used in 1996–97, the detection limits of certain metals (silver, cadmium and mercury) were not sensitive enough to verify compliance with water quality criteria.

During the 1998–99 campaign, the use of different analysis methods (see Section 2.4.5) with better detection limits corrected the situation observed in 1996–97. In addition, the list of metals analysed was increased from 11 to 19, in order to obtain a more complete analysis.

Water quality criteria exist for all metals analysed.

2.4.3 Selection of the families of chlorinated and unchlorinated organic substances

Several organic substances are potentially present in municipal effluents, especially if industrial facilities are connected to the sewer system. The concentrations of these substances are therefore hard to predict, particularly as effluents are mixed into the sewer system and diluted by seepage and catchment water. They also depend on the effectiveness of the treatment applied by the municipal treatment plant and on any pre-treatment carried out by some industrial facilities before discharging wastewater into the sewer system.

In Quebec, no exhaustive characterization of organic substances in municipal effluents had ever been done before. In the absence of data, an exploratory characterization profile was drawn up for the 1996–97 campaign. Seven families of chlorinated and unchlorinated organic compounds were retained for analytical purposes at a few specific plants.

Following an analysis of the results obtained in 1996–97, the organic substance characterization program was reviewed and the analyses were extended to all plants for the 1998–99 campaign. In addition, an eighth family of organic substances, pesticides, was added at two plants for the sampling work performed in the summer of 1999.

Table 2.6 presents the families of organic parameters selected for analysis by treatment plant, while the three following subsections provide further details on the subject.

TABLE 2.6: SELECTION OF ORGANIC ANALYSES BY TREATMENT PLANT

Treatment plant	Phenolic substances (1)	SVOCs	VOCs	Surfactants	PCBs (2)	PAHs (2)	Chlorinated dioxins and furans (2)	Pesticides
Châteauguay	S	S	S	S	S	S	S	
CUM (3)	W+S	S	W+S	W+S	W+S	W+S	S	S
CUO	S	S	S	S	S	S	S	
CUQ (East plant)	W+S	S	W+S	S	W+S	W+S	W+S	
Cookshire	W+S	W+S	W+S	W+S	W+S	S	S	
Farnham	W+S	S	W+S	W+S	W+S	W+S	S	
Jonquière	S	S	S	S	S	S	S	
La Prairie	W+S	S	W+S	S	W+S	W+S	W+S	
Longueuil (3)	W+S	S	W+S	S	W+S	W+S	W+S	S
Magog	W							
Martinville	W	W	W	W	W	W	W	
Saint-Gédéon	S	S	S	S	S	S	S	
St-Joseph-de-Beauce	S	S	S	S	S	S	S	
Sawyerville				S				
Warwick				W				

W (winter): Organic substances were analysed with samples drawn during winter operating conditions.

S (summer): Organic substances were analysed with samples drawn during summer operating conditions.

(1): Phenolic substances were analysed with a scanning analytical method for the samples drawn in winter and by colorimetry for the samples drawn in summer (see text).

(2): PCBs, PAHs and chlorinated dioxins and furans were analysed at all treatment plants with the trace analysis methods, except the CUM plant in the winter of 1996 (for PCBs and PAHs only), where basic and neutral extraction followed by scanning detection methods were used.

(3): For the CUM and Longueuil plants, the table refers to the summer of 1998, when organic analyses were carried out; pesticide analyses were carried out in summer 1999.

2.4.3.1 Phenolic substances, SVOCs, VOCs and surfactants

PHENOLIC SUBSTANCES

Certain studies conducted in the U.S. have shown that phenolic substances may be detected in municipal effluents (U.S.GAO, 1991; U.S. EPA, 1981). In addition, they are likely to be present in plant discharges of various industrial sectors (Malo and Gouin, 1977).

A scan analysis that can measure close to fifty separate phenolic substances was performed at seven plants sampled under winter conditions during the 1996–97 campaign (see Table 2.6). No acceptable result was obtained using this method and it was therefore eliminated for the 1998–99 campaign. However, a colorimetric analysis, which can proportionately combine a large array of phenolic substances into a single analytical result, was used at all plants in 1998–99.

SEMI-VOLATILE (SVOCS) AND VOLATILE (VOCS) ORGANIC SUBSTANCES

The scanning analysis methods used for these two families of compounds cover a wide spectrum of semi-volatile and volatile organic substances. The list of selected substances for these two families of compounds is defined in the SLV 2000 general characterization guide (SLV 2000, 1995).

The group of semi-volatile organic substances obtained by using basic and neutral extraction (SVOCs) covers a large array of organic substances, including certain PCBs (Aroclor), PAHs, chlorinated benzenes and phthalates. The detection limits for this method do not permit the verification of water quality criteria for certain substances, such as PCBs and many PAHs. In addition, in the Ontario study conducted by Orr *et al.* (1992), few substances analysed using this method were detected in municipal effluents and the majority of them were detected in concentrations deemed non-toxic for aquatic life.

That is why this analysis method was selected for exploratory purposes during the 1996–97 campaign (winter conditions) at the Cookshire plant, which receives significant industrial loading, and also at the CUM plant. At Cookshire, PCBs were not included in the analysis as they were already measured using the trace analysis method for organic substances. At the CUM plant, only PCBs and PAHs were analysed in order to compare the results with those obtained by Pham and Proulx (1996) using a more precise method. The results from Cookshire were discarded because they were not up to quality control standards. At the CUM, a few PAHs were detected, but no PCBs, which does not confirm the results obtained by trace analysis (Pham and Proulx, 1996).

During the 1998–99 campaign, to clarify the results and validate the analysis method for SVOCs in municipal effluents, measurements were taken at all plants. PCBs were not analysed with this method, however, because their detection limits are definitely insufficient. The list of SVOCs retained covers over 50 substances.

The analysis method for volatile organic substances (VOCs) can be used to measure over 40 compounds and covers several substance groups, many of which are often detected in municipal discharges (U.S. EPA, 1981; U.S. GAO, 1991; WWF, 1995; McDonald, 1989; Paxéus, 1996). These analyses were performed on the samples of six treatment plants under winter conditions during the 1996–97 campaign — that is, four plants where the industrial input is considered significant and two plants where it is considered non-significant. In view of the results obtained, VOCs were analysed at all plants during the 1998–99 campaign.

The list of SVOCs and VOCs analysed, as well as their detection limits, are presented with the complete campaign results in Appendix 8.

SURFACTANTS

Surfactants are organic molecules that include hundreds of different compounds. They are used, among other things, as cleaning agents for domestic as well as industrial purposes. Apart from their cleansing properties, they are also used for their disinfecting and softening properties, and as loosening agents. They are therefore likely to be found in the effluents of various industrial (textiles, cleaners, cosmetic products, pulp and paper) and institutional (hospitals) facilities as well as in domestic effluents.

It was therefore deemed appropriate, for exploratory purposes, to additionally analyse for nonionic and anionic surfactants at five plants during the 1996–97 campaign. As the results were significant, surfactant analyses were carried out at all plants in 1998–99.

2.4.3.2 *Trace levels of organic substances: PCBs, PAHs and chlorinated dioxins and furans*

PCBs, PAHs and chlorinated dioxins and furans are toxic substances that are generally present in very small concentrations. One analytical approach can be used to detect these substances at much lower thresholds (pg/L) than with traditional scanning methods (g/L). This approach is based on filtration, extraction, purification and measurement of contaminants by gas chromatography/high resolution mass spectrometry (GC-HRMS) or by gas chromatography/tandem mass spectrometry (GC-MS/MS) (Cossa *et al.*, 1998). In addition, when the targeted substances in the sample are found in trace amounts, measurements can be carried out on sample portions of approximately 18 L (commonly known as "large volume") instead of 1-L volumes, which makes for lower detection limits. However, this large-volume extraction technique does not provide as effective an analysis resolution as do smaller-volume methods.

The results of both the mass balance of chemical contaminants in the St. Lawrence River project (Cossa *et al.*, 1998) and the study of the CUM effluent (Pham and Proulx, 1996) have demonstrated the effectiveness of the method in detecting these substances at very low concentrations. The CUM plant study also showed that concentrations of PCBs and PAHs measured at the inlet (before treatment) and in the effluent (after treatment) were much higher than in St. Lawrence River water (Pham and Proulx, 1996; Pham, 1993).

These trace-level analyses of organic substances were therefore selected for a few plants only in 1996–97 (winter conditions: see Table 2.6), and then for all plants during the 1998–99 campaign.

PCBs
Polychlorinated biphenyls (PCBs) are a family of 209 congeners divided into 10 sub-classes (homologue groups). In North America, all PCBs were produced under the trademark Aroclor (BEST, 1980), corresponding to mixtures of various congeners. Because of their great chemical stability and physical properties, PCBs had many industrial applications.

They were used in long-running applications (closed circuit), such as the dielectric fluids used in transformers and condensers, hydraulic equipment and heat exchanger fluids. They were also used in short-running applications (open circuit) for the fabrication of a number of products, such as lubricants, plastics, paint, waxes, glues, inks, textiles, dust guard agents, cutting oils, etc. (Carrier, 1991).

In the 1970s, concerns voiced over the effects on the environment and on health led to the replacement of PCBs, and, in 1977 in North America, finally resulted in the prohibition on the production, importation and use of these substances in most non-electrical applications (Environment Canada, 1981). In spite of this, they are still pervasive in the environment because of their great stability and persistent and bioaccumulable nature.

Even today, PCBs can be released into the environment due to leaking of heat transport liquids contained in condensers and transformers or when accidental spills occur. They may also be produced unintentionally in the form of impurities or by-products in many chemical processes such as the synthesis of chlorobenzene, chlorinated solvents, chlorinated alkanes or pigments (MEF, 1995). PCBs may also be formed during the thermal degradation of chlorinated organic compounds in municipal incinerators (MENV, 1995).

Several studies attest to the presence of PCBs in municipal effluents and in the aquatic environment in urban areas. The use of tracers (aquatic mosses) has revealed the presence of PCBs in several drainage basins in Quebec and, in particular, downstream of municipal treatment plants (Berryman, 1996a and 1996b; Berryman and Nadeau, 1995, 1996 and 1999). PCBs have also been detected in the water at several sampling sites in the St. Lawrence River (Cossa *et al.*, 1998; Pham and Proulx, 1996) and the Ottawa River, its main tributary (Cossa *et al.*, 1998). In Ontario, PCBs were analysed in the effluents of several municipal treatment plants (Canviro, 1989), whereas practically no analyses had been conducted previously in Quebec, with the exception of those performed on CUM plant effluent (Pham, 1993; Pham and Proulx, 1996). It was therefore appropriate to include these analyses in our study.

As part of this study, 43 specific PCB congeners, in addition to homologue groups, were analysed. During the 1996–97 campaign, nine homologue groups were analysed, which represents 206 possible substituted congeners with two chlorine atoms or more. During the 1998–99 campaign, the dichlorobiphenyls group was not analysed, which represents 194 possible substituted congeners with three chlorine atoms or more. The list of PCBs analysed and complete results are presented in Appendix 10.

PAHs

Polycyclic aromatic hydrocarbons (PAHs) include several organic compounds that contain at least two benzene rings. There are many sources of PAHs. In Quebec, the biggest source of PAHs would probably be atmospheric emissions from aluminum plants using the Söderberg process. Other significant sources of PAH releases are residential wood heating, the burning of wood wastes, forest fires and fossil fuel combustion by various modes of transportation (Lavalin Environment, 1988). Oil spills and refinery effluents also seem to be significant sources of contamination of aquatic environments (CCME, 1999).

As is the case for PCBs, several studies attest to the presence of PAHs in municipal effluents, in the St. Lawrence River and in various other Quebec rivers.

Twenty-two PAHs were analysed at the plants sampled in 1996, 1997 and 1998. That number grew to 50 in 1999 because of additional measurement standards acquired by the lab responsible for the analyses. The list of PAHs analysed and complete results are presented in Appendix 11.

CHLORINATED DIOXINS AND FURANS

Dioxins and furans are not products purposely made for commercial or industrial use. They are formed during combustion activities or as undesirable by-products of certain manufacturing processes of chemical compounds (Dy, 1985). In all cases, they are released into the environment in the form of a complex mixture of various congeners.

Although certain natural combustion phenomena such as forest fires may be sources of dioxins and furans in the environment, human activities generate the highest concentrations. Among the biggest potential anthropogenic sources in Canada are atmospheric releases due to the combustion of municipal, industrial, medical and hazardous wastes of all kinds, and particularly cement kilns and steel works (NACEC, 2000; CCME, 1999). Wood combustion (residential heating, fires, combustion of wood wastes treated with pentachlorophenol) as well as the combustion of fossil fuels (coal, heating oil, automobile exhaust) are also emission sources that may release small quantities into the environment (Carrier, 1991).

Certain industrial processes also generate dioxins and furans. Such is the case for the chlorine bleaching process used by certain pulp and paper plants (Trudel, 1991; MENV, 2000) as well as facilities that use colorants and pigments (Williams *et al.*, 1992; Remmers *et al.*, 1992). Effluents from the textile industry and even domestic wash-water may also contain dioxins and furans originating from clothing fabric dyes (Horstmann and McLachlan, 1994 and 1995). Other sources are the application of products contaminated by dioxins and furans, such as certain pesticides and chlorinated solvents.

There are therefore multiple paths of transmission and the potential for dioxins and furans to be present in municipal wastewater is obvious.

Seventeen specific congeners were measured as part of the study, along with five homologue groups of substituted dioxins and furans having four to eight chlorine atoms each. The list of chlorinated dioxins and furans analysed and the complete results are presented in Appendix 13.

2.4.3.3 Pesticides

Many types of pesticides can be used in urban environments: pesticides used for treating lawns and decorative residential plants (trees, shrubs), parks and golf courses; those used for extermination purposes in residential buildings or in the food industry; and biocides used in air-conditioning systems or for the treatment of industrial fluids (preservation of metallurgical fluids, process water in the pulp and paper industry or industrial water cooling systems). Since biocides and products used in pest extermination are usually not discharged into sewer systems, research was focused on products used in landscape maintenance. These products are likely to get into the sewers and travel to the treatment plant during a rainfall.

Two types of lab analyses were carried out (see Section 2.4.5) to verify the presence of 46 pesticides used in landscape maintenance. Of these, the herbicides 2,4-D, mecocrop and dicamba are particularly targeted because of their use in urban areas, along with the insecticides diazinon, chlorpyrifos, dimethoate, carbaryl and malathion. The list of pesticides analysed and their detection limits are presented in Appendix 14.

2.4.4 Sampling methods

Sampling and sample delivery to the laboratories were carried out in accordance with the requirements of the SLV 2000 general characterization guide (SLV 2000, 1995).

For the majority of the physico-chemical analyses, 24-hour composite samples were drawn from the effluents of the mechanical treatment plants (activated sludge, biofiltration and physico-chemical processes) and spot samples were collected in the effluents of plants with aerated and unaerated lagoons. These sampling practices are consistent with those used in the monitoring programs established by the MENV. The samples were then immediately sent to the contract labs certified by the MENV and to the *Centre d'expertise en analyse environnementale du Québec* (CEAEQ).

In the case of the trace-level analyses of organic substances, the volume of water sampled was approximately 18 L. Water samples were collected in 20-L stainless steel containers treated with organic solvents (Cossa *et al.*, 1996), and protected against atmospheric deposition by a Teflon sheet. Upon reception at the St. Lawrence Centre lab, the samples were prepared and sent to the CEAEQ for analysis.

The personnel of the CUM and Longueuil plants performed the pesticide sampling work in accordance with the procedures described below. In both these cases, the samples were stored in coolers and immediately sent via express mail to the CEAEQ.

At the CUM plant, samples were collected at the settling tank outlets, using the plant's Manning model sampler. The sampler was adequately equipped to measure organic pollutants (Teflon and silicone tubing, glass containers). The sampler was pre-set to collect an 85-mL sample every hour, for a total of two litres per 24-hour period. These composite samples were collected three times a week on Mondays, Tuesdays and Wednesdays, from May 17 through July 28, 1999. Each composite sample was divided into two sub-samples. One was put into a 1-L, previously-acidified (H_2SO_4) glass bottle for the analysis of phenoxyacid pesticides, while the other was placed in a 500-mL container to be scanned for organophosphorus substances (OPS). Thirty composite samples were collected.

At the Longueuil plant, during three heavy rainfall events that occurred between May 19 and September 7, 1999, a total of 12 samples were collected to obtain four composite samples. Water samples were collected at the outlets of the settling tanks using an ISCO 3700-type sampler. The sampler was adequately equipped to measure organic pollutants and included 24 350-mL glass bottles. It was set at the start of each rainfall to collect four series of six 350-mL samples. The six samples were collected in sequence and the four series of samples were spread over the cumulative volume curve of the plant. The six 350-mL samples were mixed together, shaken and transferred into the 1-L bottles, for the phenoxyacid pesticides, and into the 500-mL bottles, for the OPS scan.

2.4.5 Analysis methods

The SLV 2000 general characterization guide (SLV 2000, 1995) served as a reference for sample conservation requirements and for the analysis methods regarding the following parameter groups:

- the conventional physico-chemical parameters (PCP);
- the 11 metals of the 1996–97 characterization campaign;
- the semi-volatile organic substances (SVOCs);
- the volatile organic substances (VOCs);
- the phenols of the 1998–99 campaign (4-AAP colorimetric method).

The 19 metals of the 1998–99 characterization campaign were analysed using the 200-Mét. 1.0 and 200-Hg methods developed at the Centre d'expertise en analyse environnementale du Québec (CEAEQ).

During the 1996–97 campaign, the phenolic substances were analysed using the MENVIQ.92-01/414-Phé 1.1 scanning method.

Total residual chlorine was analysed on site at the Magog plant during the 1996–97 campaign using colorimetric tubes (Hach).

Nonionic surfactants were analysed using the method called *Nonionic Surfactants as CTAS (cobalt thiocyanate active substances)* and anionic surfactants were analysed with the method *Anionic Surfactants as MBAS (methylene blue active substances)*. These two methods are taken from the *Standard Methods for the Examination of Water and Wastewater, 19th Edition* (APHA, AWWA and WEF, 1995).

The preparation and analysis techniques described in Cossa *et al.* (1996), CEAEQ (1997) and Cossa *et al.* (1998) were used for the analysis for trace levels of PCBs, HAPs and chlorinated dioxins and furans.

In the case of pesticides, the analysis of phenoxyacid herbicides (scanning of 14 compounds) was carried out as per the MA 403-P CHLP 2.0 method of the CEAEQ and the OPS analysis (scanning of 32 pesticides, such as triazine, organophosphorous, carbamates and others) was carried out using the MA 403 – Pest 3.0 method of the CEAEQ.

2.4.6 Quality control

Stringent quality control procedures were followed throughout the physico-chemical analyses, as described in the SLV 2000 general characterization guide (SLV 2000, 1995) and in accordance with the *Guide SCA-01* of the CEAEQ certification office.

3 RESULTS

This chapter synthesizes the analytical results. Note that the complete toxicity test results and the results of the physico-chemical analyses are given in the Appendices.

Operating data on the plants studied during both sampling periods are presented first. Toxicity test results are given afterwards, using two different approaches: the protection of the aquatic environment approach used by the MENV and by other environmental protection organizations (Environment Canada, and U.S. EPA), and the PEEP approach used by Environment Canada's St. Lawrence Centre. The results of the physico-chemical analyses are given last.

3.1 *Plant Operation during Sampling*

Appendix 2 provides a summary of the operating conditions at the treatment plants during sampling. Overall, the treatment plants operated normally throughout the sampling campaign. Flow rate measurement results are relatively reliable, because they were obtained, for the most part, during low infiltration periods. However, a few sewer overflows were observed upstream from some plants (see Appendix 2). In all such cases, however, sampling was conducted on the part of the water that had been through all the treatment steps.

Even if high BOD_5 and SM were observed on some occasions, nothing leads us to believe that the treatment plants sampled do a poor job. Some SM concentrations are also questionable because they do not coincide with the high values of other parameters, such as P_T, or with regular monitoring results at the plant.

Those daily results that were found to be higher than periodic concentration discharge requirements are shown in Table 3.1. Note that results may occasionally exceed periodic discharge requirements, because these requirements apply to mean concentrations for the period (semester, month or week, depending on the plant) and not to a point value.

TABLE 3.1: DAILY RESULTS EXCEEDING PERIODIC DISCHARGE REQUIREMENTS AT TREATMENT PLANTS DURING SAMPLING PERIODS

Treatment plant	Date	Parameter	Measured concentration	Discharge requirement	
				Period	Concentration
CUM	Dec 13-14/96	SM	(58 mg/L)	Weekly	< 30 mg/L
CUQ	Jan 9-10/97	BOD_5	44 mg/L	Weekly	< 40 mg/L
CUO	Jan 6-7/97	SM	(59 mg/L)	Weekly	< 30 mg/L
CUO	Jan 8-9/97	SM	(167 mg/L)	Weekly	< 30 mg/L
CUO	Jan 10-11/97	SM	(89 mg/L)	Weekly	< 30 mg/L
Cookshire	Jan 7/97	BOD_5	35 mg/L	Winter semester	< 25 mg/L
La Prairie	Dec 6-7/96	SM	112 mg/L	Monthly	< 30 mg/L
Longueuil	Dec 13-14/96	SM	(57 mg/L)	Weekly	< 30 mg/L
Longueuil	Sept 28-29/98	SM	48 mg/L	Weekly	< 30 mg/L
Longueuil	Sept 28-29/98	P_T	1.05 mg/L	Weekly	< 0.75 mg/L
Longueuil	Oct 30-Nov 1/98	P_T	0.85 mg/L	Weekly	< 0.75 mg/L
Warwick	Jan 27/97	BOD_5	22 mg/L	Winter term	< 20 mg/L

( ): Questionable results in parentheses.

Temperature, pH and dissolved oxygen measurement results, carried out on-site during sampling, are given in Appendix 3.

Dissolved oxygen measurements show no irregularity. All plants discharged well-oxygenated effluents during sampling.

Significant fluctuations in levels of pH were detected at the Farnham plant during the 1997 sampling period. Sampling there took place during winter operating conditions. Some reductions in pH were noted, the biggest being a drop from 7.00 to 6.05 pH units, which lasted for a few minutes. On June 14, 1999, a significant decline in pH (7.4 to 6.7) was also recorded in the effluent of the La Prairie plant, this one lasting about two hours. The Saint-Joseph-de-Beauce effluent was particularly acidic during the sampling in summer 1998, pH values being in the 6.0, 6.9, and 5.9 range.

No irregularities were reported in the temperature of effluents. During winter sampling at mechanized plants, the temperature of the effluent decreased progressively as the cold season set in. For aerated lagoons, the temperature of the effluent in winter remained close to the freezing point. During summer sampling, temperatures measured reflect typical summer levels (generally between 15 and 24°C) at all the plants.

The effluent from the Martinville unaerated lagoons differs from the other plants because of periodic emptying. Particularly high pH and dissolved oxygen concentrations were measured during autumnal lagoon emptying (8.0 to 8.8 pH units and 8.7 to 11.2 mg/L, respectively), and relatively high temperatures were observed during the late spring emptying (15 to 16°C).

In the case of the Magog plant, chlorine was indeed added before filtration, according to the current annual analysis. Sampling was therefore carried out under normal operating conditions.

When sampling was performed at the Saint-Joseph-de-Beauce plant in summer 1998, excessive organic loads and a decrease in dissolved oxygen concentrations were observed in the plant's lagoons. Although this situation did not stop the plant from obtaining good BOD_5 (< 10 mg/L) and ammonia nitrogen (< 2 mg/L) results, it was probably not favourable to complete nitrification, as shown by the high nitrite concentrations measured (11 to 25 mg/L).

3.2 *Toxicity Tests*

3.2.1 MENV approach for the protection of the aquatic environment

The MENV has defined two overall toxicity limits for effluents: one acute toxicity limit, to be respected at all times in the effluent, and a chronic toxicity limit, to be respected on an average basis over a relatively short period of time (e.g. 4 days) in the environment. These two limits were established to ensure that there are no major short-term consequences on aquatic organisms at the discharge point and that concentrations in the environment allow the survival, development, growth and reproduction of aquatic organisms throughout their life cycles. These limits, however, are not translated into discharge requirements for municipal effluents.

An effluent is considered to be acutely toxic to aquatic life when, undiluted, it leads to a 50% or more mortality rate in test organisms in one or more toxicity tests, when the organisms are exposed thereto for a short period of time relative to their life expectancy. The acute lethal effect is considered to decrease rapidly when the effluent mixes with the aquatic environment. Tests carried out on rainbow trout (*O. mykiss*) and daphnias (*D. magna*) correspond to acute toxicity tests, with LC_{50}s (median lethal concentration) being the toxicity thresholds to verify.

In addition, because the quality of effluents varies and the number of tests carried out does not allow this variability to be quantified, all mortality rates between 10 and 50% indicate that an effluent has the potential to exceed the 50% death criterion at some other time.

An effluent is considered to be chronically toxic for aquatic life when it can harm growth, reproduction or survival of organisms subject to one or more toxicity tests for an exposure period equivalent to 10% of their life expectancy. Tests carried out on fathead minnows (*P. promelas*), cladocerans (*C. dubia*) and algae (*S. capricornutum*) correspond to chronic toxicity tests. Although these tests are carried out in the laboratory and over a relatively short period of time, they are designed to represent the sensitivity of a long-term test via the use of sensitive stages of the organisms (*P. promelas*) or the observation of many generations of organisms. (*C. dubia* and *S. capricornutum*) (U.S. EPA, 1994).

The no-observed effect concentration (NOEC) was used as toxicity threshold for the chronic toxicity tests (MENV 1998; Stephan *et al.*, 1985).

To simplify the presentation of results, the acute toxicity criterion is represented by one acute toxicity unit in the effluent (1 TUa), which corresponds to $100/LC_{50}$ (in % v/v). Likewise, the chronic toxicity limit is represented by one chronic toxicity unit (1 TUc), which corresponds to 100/NOEC (in % v/v). Any result exceeding 1 TUa indicates that the effluent is acutely toxic for aquatic organisms, while any result exceeding 1 TUc indicates the minimum required dilution in the receiving water for the effluent to reach a concentration below the toxic threshold.

3.2.1.1 *Acute lethal toxicity*

Acute lethality test results on *O. mykiss* and *D. magna* are presented in tables 3.2-W (winter) and 3.2-S (summer). Results are given for each daily sample collected over one week (days 1, 3 and 5) as a percentage of mortality (undiluted effluent) and in acute toxicity units (TUa).

3.2.1.2 *Chronic toxicity*

The chronic toxicity tests used in the MENV approach for the protection of the aquatic environment were carried out with a two-day water renewal rate (i.e. the day 1 sample starts the testing, while the day 3 and 5 samples are used to renew the water on days 3 and 5, respectively). A single result is thus obtained with the three daily samples. In the case of the algal test, it is conducted using a three-day composite sample.

The chronic toxicity test results for *S. capricornutum*, *P. promelas* and *C. dubia* are shown in tables 3.3-W and 3.3-S in chronic toxicity units (TUc).

TABLE 3.2-W: ACUTE TOXICITY TEST RESULTS CONSIDERED IN THE MENV APPROACH FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT (WINTER)

Treatment plant (winter)	Characteristics			Mortality percentage [1] (D1 – D3 – D5)		Acute toxicity units (TUa) 100/LC_{50}	
	Treatment process	Industrial inputs	Dephos-phatization	*D. magna*	*O. mykiss*	*D. magna*	*O. mykiss*
Farnham	AS	high	without	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
La Prairie	AS	high	without	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
Magog	AS	high	with	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
CUO	AS	low	with	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
Jonquière	AS	low	without	0 - 0 - 0	0 - * - 0	nl - nl - nl	nl - * - nl
Châteauguay	BF	low	without	0 - 0 - 0	* - 0 - 0	nl - nl - nl	* - nl - nl
CUQ (East plant)	BF	low	without	0 - 0 - 0	0 - 22 - 0	nl - nl - nl	nl - <1 - nl
Cookshire	AL	high	without	100 - 100 - 90	100 - * - 100	3.2 - 1.6 - 2	>1 - * - >1
Saint-Joseph-de-Beauce	AL	high	without	0 - 0 - 0	100 - 100 - 100	nl - nl - nl	>1 - >1 - >1
Warwick	AL	high	without	0 - 0 - 0	100 - 100 - *	nl - nl - nl	>1 - >1 - *
Saint-Gédéon	AL	low	without	0 - 0 - 0	63 - 75 - 100	nl - nl - nl	>1 - >1 - >1
Sawyerville	AL	low	without	0 - 0 - 10	29 - 14 - *	nl - nl - <1	<1 - <1 - *
Martinville	UL	low	with	0 - 0 - 0	* - * - *	nl - nl - nl	* - * - *
CUM	PC	high	with	0 - 0 - 0	0 - 0 - ns	nl - nl - nl	nl - nl - ns
Longueuil	PC	low	with	0 - 0 - 0	ns- 0 - ns	nl - nl - nl	ns - nl - ns

Treatment type:

AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

Results:

<1: less than 50% of mortality
>1: more than 50% of mortality in the undiluted effluent
LC_{50}: median lethal concentration
nl: non-lethal (0% of mortality)
*: result rejected
ns: non-significant

(1): Mortality percentage measured in 100% effluent (undiluted).

TABLE 3.2-S: ACUTE TOXICITY TEST RESULTS CONSIDERED IN THE MENV APPROACH FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT (SUMMER)

Treatment plant (summer)	Characteristics			Mortality percentage (1) (D1 – D3 – D5)		Acute toxicity units (TUa) 100/LC_{50}	
	Treatment process	Industrial inputs	Dephos-phatization	*D. magna*	*O. mykiss*	*D. magna*	*O. mykiss*
Farnham	AS	high	with	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
La Prairie	AS	high	without	0 - 0 - 0	100 - 100 - 100	nl - nl - nl	1.4 - 1.7 - 1.9
Magog	AS	high	with				
CUO	AS	low	with	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
Jonquière	AS	low	without	0 - 0 - 20	0 - 0 - 10	nl - nl - <1	nl - nl - <1
Châteauguay	BF	low	with	5 - 0 - 0	29 - 90 - 29	<1 - nl - nl	<1 - 1.5 - <1
CUQ (East plant)	BF	low	without	0 - 0 - 0	0 - 0 - 0	nl - nl - nl	nl - nl - nl
Cookshire	AL	high	without	30 - 85 - 60	0 - 0 - 0	<1 - 2.9 - 1.4	nl - nl - nl
Saint-Joseph-de-Beauce	AL	high	with	100 -100 - 20	0 - 0 - 0	1.4 - 1.4 - <1	nl - nl - nl
Warwick	AL	high	with				
Saint-Gédéon	AL	low	without	0 - 0 - 10	0 - 0 - 10	nl - nl - <1	nl - nl - <1
Sawyerville	AL	low	with	8 - 0 - 0	* - 0 - 0	<1 - nl - nl	* - nl - nl
Martinville	UL	low	without	0 - 0 - 0 - 0	* - 0 - 0 - 0	nl-nl-nl-nl	*-nl-nl-nl
CUM (1998)	PC	high	with	0 - 0 - 0	0 - 10 - 0	nl - nl - nl	nl - <1 - nl
CUM (1999)	PC	high	with	0 - 0 - 0	0 - 0 - 14	nl - nl - nl	nl - nl - ns
Longueuil (1998)	PC	low	with	100 - 100 - 90	100 - 100 - 100	3 - 1.4 - 1.3	2.8 – 2.8 – 1.4
Longueuil (1999)	PC	low	with	0 - 0 - 0	86 - 43- 43	nl - nl - nl	1.3 - <1 - <1

Treatment type:

AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

Results:

<1: less than 50% of mortality
>1: more than 50% of mortality in the undiluted effluent
LC_{50}: median lethal concentration
nl: non-lethal (0% of mortality)
*: result rejected
ns: non-significant

(1): Mortality percentage measured in 100% effluent (undiluted).

TABLE 3.3-W: CHRONIC TOXICITY TEST RESULTS CONSIDERED IN THE MENV APPROACH FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT (WINTER)

Treatment plant (winter)	**Characteristics**			**Chronic toxicity units (TUc) 100/NOEC**		
	Treatment process	**Industrial inputs**	**Dephos-phatization**	***S. capricornutum***	***P. promelas***	***C. dubia***
Farnham	AS	high	without	Stimulation	4	2
La Prairie	AS	high	without	Stimulation	5.9	1
Magog	AS	high	with	Stimulation	2	1
CUO	AS	low	with	Stimulation	8	1
Jonquière	AS	low	without	Stimulation	2	1
Châteauguay	BF	low	without	Stimulation (1)	2	1
CUQ (East plant)	BF	low	without	Stimulation	> 17	2
Cookshire	AL	high	without	4.4	8	16
Saint-Joseph-de-Beauce	AL	high	without	Stimulation	17	2
Warwick	AL	high	without	Stimulation	7.7	2
Saint-Gédéon	AL	low	without	Stimulation	2	1
Sawyerville	AL	low	without	2.2	2	1
Martinville	UL	low	with	Stimulation	1	1
CUM	PC	high	with	Stimulation	(> 100)	4
Longueuil	PC	low	with	Stimulation	11	2

Treatment type:
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

( ): Questionable result; to be considered with caution
NOEC: no-observed effect concentration

(1): Growth inhibition at the highest tested concentration (100% v/v), but result is non-significant.

Table 3.3-S: Chronic Toxicity Test Results Considered in the MENV Approach for the Protection of the Aquatic Environment (Summer)

Treatment plant (summer)	**Characteristics**			**Chronic toxicity units (TUc) 100/NOEC**		
	Treatment process	**Industrial inputs**	**Dephos-phatization**	***S. capricornutum***	***P. promelas***	***C. dubia***
Farnham	AS	high	with	Stimulation	1	1
La Prairie	AS	high	without	Stimulation	4	4
Magog	AS	high	with			
CUO	AS	low	with	Stimulation	4	1
Jonquière	AS	low	without	Stimulation	16	16
Châteauguay	BF	low	with	Stimulation	2	2
CUQ (East plant)	BF	low	without	Stimulation	4	1
Cookshire	AL	high	without	Stimulation	17	4
Saint-Joseph-de-Beauce	AL	high	with	Stimulation	1	16
Warwick	AL	high	with			
Saint-Gédéon	AL	low	without	Stimulation	4	16
Sawyerville	AL	low	with	Stimulation	1	2
Martinville	UL	low	without	Stimulation	1	1
CUM (1998)	PC	high	with	Stimulation		4
CUM (1999)	PC	high	with	Stimulation	33	4
Longueuil (1998)	PC	low	with	Stimulation		16
Longueuil (1999)	PC	low	with	Stimulation	2	2

Treatment type:
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

NOEC: no-observed effect concentration

3.2.2 Toxic print component of the PEEP Index

The PEEP Index combines into one value the results of five toxicity tests performed on five organisms at different trophic levels (e.g. decomposers, primary producers, consumers), for a total of six "effect parameters" (e.g. survival, reproduction, growth and genotoxicity). The PEEP concept and the application thereof are described in detail in Costan *et al.* (1993). A brief description is provided below and additional information can be found in Appendix 5.

All results are expressed in toxicity units. This strategy, along with a determination of the persistence of toxicity and the integration of the flow rate measured at the effluent (to evaluate the toxic load), constitutes a first attempt to incorporate various fundamental ecotoxicological concepts into a single discriminating work tool. The following tests are used to determine the PEEP Index: *V. fischeri*, *E. coli* PQ 37 (genotoxicity only), *S. capricornutum* and *C. dubia* (mortality and reproductive inhibition).

PEEP units are calculated from the threshold effect concentration (TEC). This value is the result of the geometric mean of the no-observed effect concentration (NOEC) and the lowest observed effect concentration (LOEC). The PEEP Index provides two types of measurements: the "toxic print" and the "toxic load". The toxic print component represents the relative importance of the scope of the toxic intensity and expresses, in adjusted toxic units per bioanalytical volume unit ($ATU.bvu^{-1}$), the concentration of potentially bioavailable substances. The toxic load component is the product of the toxic print by the flow rate. It is expressed in $ATU.h^{-1}$ and allows for an assessment of the relative contribution of the effluent to the overall toxicity of the discharge considered (Bermingham and Boudreau, 1994).

Within the scope of this study, only the toxic print component of the PEEP Index was used. It is the most appropriate to attain the study's objectives and to compare municipal effluents on a common basis.

Table 3.4 presents the qualitative results of the toxicity tests. Toxic print results are shown in Table 3.5.

TABLE 3.4: QUALITATIVE RESULTS OF THE TOXICITY TEST CONSIDERED IN THE PEEP INDEX (WINTER AND SUMMER)

Treatment plant	Characteristics			Winter										Summer									
				V. fischeri		*E. coli* PQ 37				*S. capricornutum*		*C. dubia*		*V. fischeri*		*E. coli* PQ 37				*S. capricornutum*		*C. dubia*	
	TT	II	Deph W/S	Luminescence		Genotox. - S9		Genotox. + S9		Growth		Reproduction	Lethality	Luminescence		Genotox. - S9		Genotox. + S9		Growth		Reproduction	Lethality
				U	A	U	A	U	A	U	A	U	NA	U	A	U	A	U	A	U	A	U	NA
Farnham	AS	high	wo/w	-	-	++	++	++	+	-	-	-	-	-	-	-	-	+++	++	-	-	-	-
La Prairie	AS	high	wo/wo	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+
Magog	AS	high	w/w	-	-	+	-	-	-	-	-	-	-										
CUO	AS	low	w/w	-	-	+	-	-	-	-	-	-	-	-	-	++	++	-	-	-	-	-	-
Jonquière	AS	low	wo/wo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Châteauguay	BF	low	wo/w	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CUQ (East plant)	BF	low	wo/wo	-	-	++	+	+	-	-	-	-	-	-	-	++	-	-	-	-	-	+	-
Cookshire	AL	high	wo/wo	-	-	++	++	-	++	+	+	+	+	+	-	++	+	++	-	-	-	+	-
Saint-J.-de-Beauce	AL	high	wo/w	-	-	+++	+++	+++	+++	-	-	+	-	-	-	+++	+++	++	++	-	-	++	++
Warwick	AL	high	wo/w	-	-	++	-	-	-	-	-	+	-										
Saint-Gédéon	AL	low	wo/wo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-
Sawyerville	AL	low	wo/w	-	-	+++	+++	+++	+++	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Martinville	UL	low	w/wo	-	-	+++	+++	+++	+++	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CUM (S-98)	PC	high	w/w	+	-	+	+	-	-	+	-	+	-	-	-	-	-	-	-	-	+	+	+
Longueuil (S-98)	PC	low	w/w	-	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	+

Treatment type (TT)

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
w:	with dephosphatization
wo:	without dephosphatization
W:	winter
S:	summer

Legend:	
-	(no toxicity)
+	(TEC = 1- 6 TU)
++	(TEC = 7-11 TU)
+++	(LOEC > 11 TU)
A:	aerated sample
U:	unaerated sample
- S9:	without metabolic activation
+ S9:	wtih metabolic activation

TABLE 3.5: PEEP INDEX TOXIC PRINT COMPONENT RESULTS (WINTER AND SUMMER)

Treatment plant	**Characteristics**			**PEEP Index toxic print component (ATU.bvu^{-1}) (1) (2) (= n x [Σ TEC / N])**	
	TT	**II**	**Deph W / S**	**Winter**	**Summer**
Farnham	AS	high	wo/w	15.8	6.8
La Prairie	AS	high	wo/wo	0.2	0.6
Magog	AS	high	w/w	0.3	
CUO	AS	low	w/w	0.6	4.5
Jonquière	AS	low	wo/wo	<	0.3
Châteauguay	BF	low	wo/w	<	<
CUQ (East plant)	BF	low	wo/wo	6.8	2.6
Cookshire	AL	high	wo/wo	34.1	17.0
Saint-Joseph-de-Beauce	AL	high	wo/w	91.2	54.3
Warwick	AL	high	wo/w	2.5	
Saint-Gédéon	AL	low	wo/wo	<	1.8
Sawyerville	AL	low	wo/w	81.5	0.3
Martinville	UL	low	w/wo	72.4	<
CUM (S-98)	PC	high	w/w	7.8	3.1
Longueuil (S-98)	PC	low	w/w	1.4	3.4

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
w: with
wo: without
W: winter
S: summer

<: below detection limit
n: number of tests exhibiting (geno)toxicity
N: total number of tests performed
TEC: threshold effect concentration

(1): The toxic print detection limit = 0.1 ATU.bvu^{-1}.
(2): Data were calculated with the results obtained in the unaerated samples.

3.2.3 Physico-chemical analyses used to support toxicity tests

All the samples subject to toxicity testing respected the pH, temperature and dissolved oxygen requirements described in the protocols. The results for total residual chlorine (TRC) almost all showed relatively high concentrations of free and combined chlorine (e.g. chloramines). These values do not explain toxicity differences, however, but because of the nature of the effluents analysed, the results obtained for TRC are probably invalid (see Appendix 7). Appendix 7 gives the results of the physico-chemical analyses conducted in support of the toxicity tests. These analyses were carried out on the daily turnover water samples and on the unaerated part of the composite sample for each effluent studied.

3.2.4 Quality control

The 30 municipal effluent characterizations produced close to 400 biological analyses. Almost all toxicity test results were accepted upon reception because the quality requirements defined in the SLV 2000 general characterization guide (SLV 2000, 1995) were all respected. Results that did not comply with requirements were rejected (identified by asterisks in the tables). More information on the quality assessment of the results may be obtained from any of the 30 scientific and technical biological characterizations of the treatments plants, published by Environment Canada's St. Lawrence Centre (Bombardier, M.; Harwood, M., 1996 to 1999).

3.3 Physico-chemical Analyses

3.3.1 Conventional physico-chemical parameters and metals

The analytical results of the conventional physico-chemical parameters (PCPs), expressed as mean concentrations for the three sampling days, are presented in tables 3.6-W and 3.6-S (winter and summer respectively). Likewise, the results of the metal analyses for the municipal effluents, expressed as mean concentrations of the total extractable metal, are given in tables 3.7-W and 3.7-S. Complete results and detection limits are detailed in Appendix 8.

TABLE 3.6-W: MEAN CONCENTRATIONS OF CONVENTIONAL PHYSICO-CHEMICAL PARAMETERS (WINTER)

Treatment plant (winter)	Characteristics			Physico-chemical parameters (mg/L)																	
	TT	II	Deph	BOD_5	COD	SM	P_t	TKN	NH_3-NH_4+	NO_2^-	NO_3^-	NO_2-NO_3	Dissolved sulfides	Total sulfides	Sulfates	Min. O&G	Phenol. subst.	Cl^-	CN^-	F^-	Hardness	Conductivity
Farnham	AS	high	wo	*	*	11	*	3.32	1.38	0.197	0.3	0.473		0.05	47	<	<	78	<	0.46		
La Prairie	AS	high	wo	*	*	48	*	5.33	3.87	0.037	1.2	1.203		0.04	(170)	0.10	<	152	<	0.27		
Magog	AS	high	with	*	*	4	*	0.96	0.16	0.057	6.6	6.677		0.07	73	<	<	130	<	0.12		
CUO	AS	low	with	*	*	105	*	13.02	6.17	<	4.9	4.900		0.07	53	<		211	<	0.17		
Jonquière	AS	low	wo	4	28	4	0.31	3.1	2.3			3.5		<	33	0.3		42	<	0.08		
Châteauguay	BF	low	wo	*	*	11	*	8.80	8.32	0.194	2.2	2.413		0.06	73	0.69		242	<	0.74		
CUQ (East plant)	BF	low	wo	30	85	22	1.59	15.00	11.6			0.45		<	49	0.50	<	320	<	0.80		
Cookshire	AL	high	wo	25	168	12	1.5	14.0	10.7			0.6		<	40	(16)	<	368	<	0.07		
St-J.-de-Beauce	AL	high	wo	18	70	19	1.6	26	25			0.6		<	81	0.3		187	<	<		
Warwick	AL	high	wo	17	69	22	2.6	16	13			1.4		<	52	0.4		113	<	<		
Saint-Gédéon	AL	low	wo	6	52	5	1.75	11.70	10.1			1.2		<	27	0.3		95	<	0.12		
Sawyerville	AL	low	wo	6	32	4	1.5	12	10			1.2		<	19	(0.3)		64	<	<		
Martinville	UL	low	with	23	47	18	1.2	5.3	3.7	0.006	<	<	0.12	0.56	20	<	0.006	32	<	0.04	122	437
CUM	PC	high	with	*	*	35	*	9.38	6.60	0.009	0.2	0.220		0.04	68	0.18	<	182	<	0.23		
Longueuil	PC	low	with	*	*	29	*	11.73	9.81			0.164		0.05	171	0.14	<	118	<	0.16		

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

*:	result rejected
<:	result below detection limit
Blank box:	parameter not measured
( ):	questionable result quality control; to be considered with caution

TABLE 3.6-S: MEAN CONCENTRATIONS OF CONVENTIONAL PHYSICO-CHEMICAL PARAMETERS (SUMMER)

Treatment plant (summer)	Characteristics			Physico-chemical parameters (mg/L)																		
	TT	II	Deph	BOD_5	COD	SM	P tot.	TKN	NH_3-NH_4+	NO_2^-	NO_3^-	NO_2-NO_3	Dissolved sulfides	Total sulfides	Sulfates	Min. O&G	Phenol. subst.	Cl^-	CN^-	F^-	Hardness	Conductivity
Farnham	AS	high	with	4	37	10	0.2	2.0	0.7	0.018	1.0	1.0	<	0.01	101	<	<	80	<	0.61	179	565
La Prairie	AS	high	wo	5	41	9	0.56	25	24	0.20	0.87	1.07	<	0.02	117	<	<	182	<	0.30	283	1046
Magog	AS	high	with																			
CUO	AS	low	with	<	31	3	0.45	5.5	4.9	0.20	3.07	3.3	<	<	52	<	<	61	<	0.13	96	397
Jonquière	AS	low	wo	<	20	3	0.192	2.3	(1.9)	0.062	1.27	1.36	<	<	32	<	<	35.8	<	(0.12)	93	387
Châteauguay	BF	low	with	9	23	10	0.66	11	9.2	0.15	1.29	1.4	0.01	0.05	77	<	<	79	<	0.91	217	631
CUQ (East plant)	BF	low	wo	11	65	11	1.25	11.6	9.1	0.11	0.16	0.27	<	0.04	57	0.42	<	126	<	0.76	131	622
Cookshire	AL	high	wo	10	90	10	1.10	9.3	6.8	0.59	0.13	0.71	<	0.07	102	0.83	0.010	172	<	0.11	124	858
St-J.-de-Beauce	AL	high	with	6	89	37	0.72	3.2	(1.1)	20	4	22			113	<	<	137	0.13	(0.06)	155	928
Warwick	AL	high	with																			
Saint-Gédéon	AL	low	wo	<	36	<	2.2	9.4	(8.4)	0.57	1.3	1.8			34	<	<	65	0.05	(0.2)	142	632
Sawyerville	AL	low	with	<	23	3.6	0.43	2.9	1.6			2.3		<	29	(<)		42	0.02	0.070		
Martinville	UL	low	wo	18	130	46	0.86	6.5	<			0.32		0.09	9	<		43	<	0.059		
CUM (1998)	PC	high	with	21	104	18	0.57	9.3	4.9	<	0.03	0.03	0.02	0.09	79	0.2	0.005	87	0.02	(0.31)	162	719
CUM (1999)	PC	high	with	41	104	20	0.44	9.4	6.1	0.005	0.01	0.02	0.11	0.20	71	0.41	0.009	97	0.020	0.18	170	719
Longueuil (1998)	PC	low	with	36	140	29	0.85	14	9.5	(0.022)	0.03	0.05	0.14	0.24	106	0.2	0.010	70	<	(0.15)	195	767
Longueuil (1999)	PC	low	with	23	70	17	0.56	14	10	0.004	<	0.01	0.14	0.21	104	0.33	0.010	80	0.004	0.14	201	744

Treatment type (TT):

AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization

*: result rejected
<: result below detection limit
Blank box: parameter not measured
( ): questionable result (quality control); to be considered with caution

TABLE 3.7-W: MEAN CONCENTRATIONS OF TOTAL METALS (WINTER)

Treatment plant (winter)	Characteristics			Total metals (mg/L)																		
	TT	II	Deph	Al	Sb	Ag	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Hg	Mo	Ni	Pb	Se	V	Zn
Farnham	AS	high	wo	0.78		<					<	(0.016)		0.048	1.26	<		<	<	<		0.04
La Prairie	AS	high	wo	0.09		<					<	0.028		0.005	<	<		<	<	<		<
Magog	AS	high	with	0.35		<					<	(0.015)		(0.022)	1.17	3 E-4		<	<	<		0.14
CUO	AS	low	with	2.70		0.002					<	(0.012)		0.041	3.27	<		<	(0.0028)	<		0.09
Jonquière	AS	low	wo	0.2		<					<	0.001		0.009	0.07	<		<	0.0016	<		0.02
Châteauguay	BF	low	wo	0.06		<					<	(0.017)		0.040	1.30	<		<	<	<		0.07
CUQ (East plant)	BF	low	wo	0.3		0.008					<	0.005		0.020	0.87	<		<	0.0015	<		0.04
Cookshire	AL	high	wo	0.2		0.005					<	0.012		0.040	0.29	<		<	<	<		0.19
St-J.-de-Beauce	AL	high	wo	<		0.005					<	0.002		0.012	1.23	<		<	<	<		<
Warwick	AL	high	wo	0.2		0.004					<	0.001		0.005	0.35	<		<	<	<		0.02
Saint-Gédéon	AL	low	wo	0.1		0.003					<	0.002		0.017	0.28	<		<	<	<		<
Sawyerville	AL	low	wo	<		0.002					<	<		0.028	0.47	<		<	0.0013	<		0.02
Martinville	UL	low	with	0.253	<	<	0.0018	0.0057	<	0.038	<	0.0010	0.0004	0.003	0.193	2.6 E-5	<	0.002	<	0.0003	0.0006	0.003
CUM	PC	high	with	0.14		<					<	0.026		0.020	1.75	<		<	<	(0.0023)		0.08
Longueuil	PC	low	with	0.93		<					<	0.026		0.012	0.16	<		<	<	<		<

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

*:	result rejected
<:	result below detection limit
Blank box:	parameter not measured
( ):	questionable result (quality control): to be considered with caution

TABLE 3.7-S: MEAN CONCENTRATIONS OF TOTAL METALS (SUMMER)

Treatment plant (summer)	Characteristics			Total metals (mg/L)																		
	TT	II	Deph	Al	Sb	Ag	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Hg	Mo	Ni	Pb	Se	V	Zn
Farnham	AS	high	with	0.690	0.0002	<	0.0005	0.069	<	0.038	<	0.0013	0.0026	0.016	0.343	1.0 E-4	0.021	0.007	0.0013	0.0004	0.0008	0.024
La Prairie	AS	high	wo	0.113	0.0006	<	0.0006	0.016	<	0.177	<	0.0011	0.0015	0.009	0.280	1.5 E-5	0.005	0.005	0.0018	0.0006	0.0007	0.026
Magog	AS	high	with																			
CUO	AS	low	with	0.086	0.0002	<	0.0004	0.016	<	0.061	<	0.0010	0.0002	0.005	0.095	3.3 E-5	0.005	0.003	0.0004	0.0003	0.0005	0.013
Jonquière	AS	low	wo	0.125	<	<	<	0.019	<	0.052	<	0.008	<	0.008	0.057	8.0 E-6	<	<	<	<	<	0.020
Châteauguay	BF	low	with	0.587	0.0001	0.0004	0.0005	0.038	<	0.067	<	0.0023	0.0002	0.014	0.250	3.9 E-5	0.002	0.005	0.0004	0.0004	0.0007	0.013
CUQ (East plant)	BF	low	wo	0.148	0.0002	0.0022	0.0006	0.039	<	0.055	<	0.0019	0.0003	0.017	0.780	5.0 E-5	0.007	0.004	0.0014	0.0006	0.0006	0.029
Cookshire	AL	high	wo	0.049	0.0001	<	0.0010	0.017	<	0.042	<	0.020	0.0034	0.028	0.397	1.1 E-4	<	0.046	0.0008	<	0.0003	0.064
St-J.-de-Beauce	AL	high	with	0.057	<	<	0.0002	0.018	<	0.033	<	0.004	0.0009	0.010	0.497	2.2 E-5	<	0.008	0.0004	<	<	<
Warwick	AL	high	with																			
Saint-Gédéon	AL	low	wo	0.063	<	<	<	0.014	<	0.039	<	0.005	<	0.015	0.220	1.1 E-5	<	<	<	<	<	<
Sawyerville	AL	low	with	<		(<)					<	0.0142		0.002	<	<		<	<	<		<
Martinville	UL	low	wo	<		<					<	0.022		<	0.40	<		<	<	<		<
CUM (1998)	PC	high	with	0.963	<	0.0011	4.1 E-4	0.030	<	0.065	1.6 E-4	0.008	<	0.025	0.210	1.3 E-5	<	0.006	0.0016	0.009	<	0.031
CUM (1999)	PC	high	with	0.769	0.0015	0.0007	0.0009	0.030	<	0.076	3.1 E-4	0.0053	0.0004	0.021	0.290	1.7 E-5	0.011	0.005	0.0012	0.0044	0.0006	0.032
Longueuil (1998)	PC	low	with	2.597	<	0.0007	0.0007	0.026	<	0.100	1.0 E-4	0.026	<	0.015	0.267	1.9 E-5	<	0.007	<	<	<	0.016
Longueuil (1999)	PC	low	with	0.940	0.0001	<	0.0006	0.024	<	0.090	2.0 E-4	0.0048	0.0003	0.008	0.273	<	0.004	0.005	0.0008	0.0005	0.0013	0.016

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization

*: result rejected
<: result below detection limit
Blank box: parameter not measured
( ): questionable result (quality control); to be considered with caution

TABLE 3.8: MEAN CONCENTRATIONS OF SEMI-VOLATILE ORGANIC SUBSTANCES (SVOCS) DETECTED (WINTER AND SUMMER)

Treatment plant	Characteristics			Winter (SVOCs in µg/L)				Summer (SVOCs in µg/L)			
	TT	**II**	**Deph W/S**	1,4-Dichloro-benzene	Di-n-butyl-phthalate	Diethyl-phthalate	Nitro-benzene	1,4-Dichloro-benzene	Di-n-butyl-phthalate	Diethyl-phthalate	Nitro-benzene
Farnham	AS	high	wo/w					*	<	<	<
La Prairie	AS	high	wo/wo					*	<	1.2	<
Magog	AS	high	w/w								
CUO	AS	low	w/w					*	<	<	<
Jonquière	AS	low	wo/wo					2.1	12.1	<	<
Châteauguay	BF	low	wo/w					<	<	*	<
CUQ (East plant)	BF	low	wo/wo					*	*	*	<
Cookshire	AL	high	wo/wo	<	<	<	<	<	0.5	<	0.7
Saint-J.-de-Beauce	AL	high	wo/w					1.8	*	<	<
Warwick	AL	high	wo/w								
Saint-Gédéon	AL	low	wo/wo					1.6	11.0	<	<
Sawyerville	AL	low	wo/w								
Martinville	UL	low	w/wo	<	<	<	<				
CUM (S-98)	PC	high	w/w					2.6	*	1.2	1.2
Longueuil (S-98)	PC	low	w/w					3.1	*	1.2	<

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
w: with dephosphatization
wo: without dephosphatization
W: winter
S: summer

*: result rejected
<: result below detection limit
Blank box: parameter not measured

TABLE 3.9-W: MEAN CONCENTRATIONS OF VOLATILE ORGANIC SUBSTANCES (VOCS) (WINTER)

Treatment plant (winter)	Characteristics			Volatile organic substances (VOCs in µg/L)														
	TT	II	Deph	Bromo-dichloro-methane	tert-Butyl-benzene	1,2-Di-chloro-benzene	1,3-Di-chloro-benzene	1,4-Di-chloro-benzene	cis-1,2-Dichlo-roethy-lene	Ethylic ether	Ethyl-benzene	Styrene	Tetra-chloro-ethylene	Toluene	1,2,3-Tri-methyl-benzene	1,2,4-Tri-methyl-benzene	1,3,5-Tri-methyl-benzene	Xylenes
Farnham	AS	high	wo	<	<	<	<	<	*	<	<	<	<	*	<	<	<	<
La Prairie	AS	high	wo	<	<	<	<	<	<	1.1	<	<	<	<	<	<	<	<
Magog	AS	high	with															
CUO	AS	low	with															
Jonquière	AS	low	wo															
Châteauguay	BF	low	wo															
CUQ (East plant)	BF	low	wo	<	1.0	<	<	<	<	*	<	<	2.9	28.7	3.4	12.7	4.8	<
Cookshire	AL	high	wo	<	<	<	<	<	<	*	<	<	<	<	<	<	<	<
St-J.-de-Beauce	AL	high	wo															
Warwick	AL	high	wo															
Saint-Gédéon	AL	low	wo															
Sawyerville	AL	low	wo															
Martinville	UL	low	with	<	<	<	<	<	<	<	<	<	<	5.5	<	<	<	<
CUM	PC	high	with	0.7	<	0.7	<	<	0.4	*	2.1	0.6	3.5	10.8	*	1.9	0.5	1.8
Longueuil	PC	low	with	0.8	<	<	<	<	<	*	7.5	0.5	0.8	0.7	*	4.0	1.1	5.6

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

*:	result rejected
<:	result below detection limit
Blank box:	parameter not measured

TABLE 3.9-S: MEAN CONCENTRATIONS OF VOLATILE ORGANIC SUBSTANCES (VOC'S) (SUMMER)

Treatment plant (summer)	Characteristics			Volatile organic substances (VOCs in µg/L)														
	TT	II	Deph	Bromo-dichloro-methane	tert-Butyl-benzene	1,2-Di-chloro-benzene	1,3-Di-chloro-benzene	1,4-Di-chloro-benzene	cis-1,2-Dichlo-roethy-lene	Ethylic ether	Ethyl-benzene	Styrene	Tetra-chloro-ethylene	Toluene	1,2,3-Tri-methyl-benzene	1,2,4-Tri-methyl-benzene	1,3,5-Tri-methyl-benzene	Xylenes
Farnham	AS	high	with	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
La Prairie	AS	high	wo	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Magog	AS	high	with															
CUO	AS	low	with	<	<	<	<	<	*	<	<	<	<	<	<	<	<	<
Jonquière	AS	low	wo	<	<	<	0.3	*	<	*	<	<	1.2	0.9	<	<	<	*
Châteauguay	BF	low	with	<	<	<	<	<	*	<	<	<	1.2	<	<	<	<	<
CUQ (East plant)	BF	low	wo	<	<	<	*	*	*	<	<	<	<	<	<	<	<	<
Cookshire	AL	high	wo	<	<	<	<	<	<	<	<	<	<	*	<	<	<	<
St-J.-de-Beauce	AL	high	with	<	<	<	0.2	0.5	<	*	<	<	0.7	<	<	<	<	*
Warwick	AL	high	with															
Saint-Gédéon	AL	low	wo	<	<	<	<	*	<	*	<	<	<	<	<	<	<	*
Sawyerville	AL	low	with															
Martinville	UL	low	wo															
CUM (1998)	PC	high	with	<	<	<	<	*	<	*	0.3	0.2	*	*	<	3.2	0.9	1.6
Longueuil (1998)	PC	low	with	<	<	<	<	*	<	*	*	0.2	*	*	*	*	0.1	*

Treatment type (TT):

AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization

*: result rejected
<: result below detection limit
Blank box: parameter not measured

3.3.2 Semi-volatile and volatile organic substances (SVOCs and VOCs)

Table 3.8 presents the results for the semi-volatile organic substances (SVOCs) detected at the treatment plants during winter and summer operating conditions. Tables 3.9-W and 3.9-S give the results for volatile organic substances (VOCs). Complete SVOCs and VOCs results and detection limits are detailed in Appendix 8.

3.3.3 Nonionic and anionic surfactants

Mean concentrations of nonionic and anionic surfactants obtained in winter and summer are given in Table 3.10. Complete results and detection limits for surfactants are detailed in Appendix 9. The detection limit for nonionic surfactants in samples collected in summer at the Cookshire and Farnham plants was 10 times higher (1.0 mg/L instead of the method detection limit of 0.1 mg/L), because of the presence of scum (organic matter) on the samples. This organic matter interfered with the analysis and samples were therefore diluted.

TABLE 3.10: MEAN CONCENTRATIONS OF SURFACTANTS (WINTER AND SUMMER)

Treatment plant	**Characteristics**			**Winter**		**Summer**	
	TT	**II**	**Deph W/S**	**Nonionic surfactants (mg/L)**	**Anionic surfactants (mg/L)**	**Nonionic surfactants (mg/L)**	**Anionic surfactants (mg/L)**
Farnham	AS	high	wo/w	1.4	0.55	<(1)	0.51
La Prairie	AS	high	wo/wo			<	0.24
Magog	AS	high	w/w				
CUO	AS	low	w/w			<	0.12
Jonquière	AS	low	wo/wo			<	0.13
Châteauguay	BF	low	wo/w			0.2	0.91
CUQ (East plant)	BF	low	wo/wo			0.3	1.30
Cookshire	AL	high	wo/wo	4.0	2.10	<(1)	0.42
Saint-J.-de-Beauce	AL	high	wo/w			<	0.28
Warwick	AL	high	wo/w	0.8	0.18		
Saint-Gédéon	AL	low	wo/wo			<	0.45
Sawyerville	AL	low	wo/w			*	<
Martinville	UL	low	w/wo	<	0.17		
CUM (S-98)	PC	high	w/w	1.0	2.10	0.9	2.30
(S-99)						1.7	1.80
Longueuil (S-98)	PC	low	w/w			4.0	15.00
(S-99)						2.0	3.20

Treatment type (TT):		II:	industrial inputs	*:	result rejected
AS:	activated sludge	Deph:	dephosphatization	<:	result below detection limit
BF:	biofiltration	w:	with dephosphatization	Blank box:	parameter not measured
AL:	aerated lagoons	wo:	without dephosphatization		
UL:	unaerated lagoons	W:	winter		
PC:	physico-chemical	S:	summer		

(1): Detection limit is 1.0 mg/L for these samples (instead of 0.1 mg/L).

3.3.4 Trace levels of organic substances

Trace-level analyses of organic substances first require the separation of the dissolved and particulate phases of the samples, followed by each's extraction and purification. During the 1996–97 sampling period, the purified, dissolved and particulate phases were analysed separately. The concentration results for the two phases were added together to obtain the total concentration, in order that the results might be compared with the quality criteria defined by MENV (MEF, 1998). During the 1998–99 sampling period, purified extracts of the two phases were mixed together and then the total concentration was analysed directly from the composed extract.

3.3.4.1 PCBs

Table 3.11 gives the total mean PCB concentrations determined from the analysis of homologue groups. For the 1996–97 sampling period, the homologues gathered 206 possible PCB congeners substituted using two or more chlorine atoms, and for the 1998–99 sampling period, homologues gathered 194 congeners substituted using three or more chlorine atoms (see Section 2.4.3.2). The results are reported using total concentrations, because, to evaluate and compare the quality of effluents, only PCB total concentrations are considered relative to water quality criteria.

Details on the concentrations for the homologue groups and the 43 congeners specifically analysed, and their detection limits, are given in Appendix 10.

TABLE 3.11: MEAN CONCENTRATIONS OF TOTAL PCBS (WINTER AND SUMMER)

Treatment plant	**Characteristics**			**Total PCBs (ng/L)**	
	TT	**II**	**Deph W/S**	**Winter**	**Summer**
Farnham	AS	high	wo/w	7.84	4.09
La Prairie	AS	high	wo/w	7.13	2.44
Magog	AS	high	w/w		
CUO	AS	low	w/w		1.34
Jonquière	AS	low	wo/wo		1.13
Châteauguay	BF	low	wo/w		3.89
CUQ (East plant)	BF	low	wo/wo	8.98	8.72
Cookshire	AL	high	wo/wo	33.54 (1)	(2)
Saint-Joseph-de-Beauce	AL	high	wo/w		1.38
Warwick	AL	high	wo/w		
Saint-Gédéon	AL	low	wo/wo		1.20
Sawyerville	AL	low	wo/w		
Martinville	UL	low	w/w	2.11	
CUM (S-98)	PC	high	w/w		5.99
Longueuil (S-98)	PC	low	w/w	6.84	8.50

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
w: with dephosphatization
wo: without dephosphatization
W: winter
S: summer

Blank box: parameter not measured

(1): Mean concentration calculated from samples of days 1 and 3 only because day 5 sample was lost.

(2): Cookshire samples were impossible to analyse because they were overloaded with organic matter, which was causing interference with the analytical method.

3.3.4.2 PAHs

PAHs measured at the treatment plants are, for the most part, grouped into two categories, according to carcinogenicity. The first group includes 16 PAHs that show sufficient evidence of carcinogenicity according to the International Agency of Research on Cancer (IARC, 1987). The 28 PAHs of the second group show limited evidence of carcinogenicity, as defined by the IARC. See Appendix 12 for the list of PAHs included in each group.

Twenty-two PAHs were analysed in the effluent samples collected in 1996, 1997 and 1998. Eight PAHs belong to Group 1, 11 to Group 2, and 3 other PAHs. The number of PAHs analysed was increased to 50 at stations where samples were collected in 1999 (Châteauguay, CUO, CUQ, Cookshire, Farnham and La Prairie) — that is, 16 PAHs from Group 1, 28 PAHs from Group 2, and 6 other PAHs. This leads to a bias in comparing the results of analyses carried out in 1999 with earlier work. However, these additional PAHs are substances found less frequently in municipal effluents, and do not lead to great variations in the results for Group 1 and total PAHs (only a 0 to 10% increase). Table 3.12 shows the total PAH concentrations. For complete results and detection limits, refer to Appendix 11.

There exists a water quality criterion for the prevention of contamination of aquatic organisms (CPCO) that applies to the total PAH concentration of PAH Group 1. In the case of the second group, there exists a specific quality criterion for seven PAHs. Results obtained at the treatment plants are also presented so as to take this specific quality criterion into consideration. Table 3.13 gives the total PAHs measured included in Group 1, and Table 3.14 gives the mean concentrations of the seven PAHs included in Group 2 for which specific water quality criteria exist.

TABLE 3.12: MEAN CONCENTRATIONS OF TOTAL PAHS (WINTER AND SUMMER)

Treatment plant	**Characteristics**			**Total PAHs [1] (ng/L)**	
	TT	**II**	**Deph W/S**	**Winter**	**Summer**
Farnham	AS	high	wo/w	100.6	90.6
La Prairie	AS	high	wo/wo	106.9	124.9
Magog	AS	high	w/w		
CUO	AS	low	w/w		124.3
Jonquière	AS	low	wo /wo		83.8
Châteauguay	BF	low	wo/w		248.1
CUQ (East plant)	BF	low	wo/wo	1 581.7	866.5
Cookshire	AL	high	wo/wo		96.8 (2)
Saint-Joseph-de-Beauce	AL	high	wo/w		93.3
Warwick	AL	high	wo/w		
Saint-Gédéon	AL	low	wo/wo		46.9
Sawyerville	AL	low	wo/w		
Martinville	UL	low	w/wo	174.6	
CUM (S-98)	PC	high	w/w		2 730.8
Longueuil (S-98)	PC	low	w/w	1 819.1	1 707.9

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
w: with dephosphatization
wo: without dephosphatization
W: winter
S: summer

Blank box: parameter not measured

(1) Sum of 22 PAHs at all treatment plants, except for summer results at Châteauguay, CUO, CUQ, Cookshire, Farnham and La Prairie plants, and winter result at Martinville plant, where it is the sum of 50 PAHs (see text).

(2) Mean concentration calculated from samples of days 1 and 3 only, because day 5 sample was overloaded with organic matter, which was causing interference with the analytical method.

TABLE 3.13: MEAN CONCENTRATIONS OF GROUP 1 PAHS (WINTER AND SUMMER)

Treatment plant	Characteristics			Group 1 PAHs (1) (ng/L)	
	TT	II	Deph W/S	Winter	Summer
Farnham	AS	high	wo/w	23.5	15.9
La Prairie	AS	high	wo/wo	6.6	14.7
Magog	AS	high	w/w		
CUO	AS	low	w/w		5.8
Jonquière	AS	low	wo/wo		10.7
Châteauguay	BF	low	wo/w		27.2
CUQ (East plant)	BF	low	wo/wo	20.0	29.0
Cookshire	AL	high	wo/wo		1.0 (2)
Saint-Joseph-de-Beauce	AL	high	wo/w		2.4
Warwick	AL	high	wo/w		
Saint-Gédéon	AL	low	wo/wo		4.0
Sawyerville	AL	low	wo/w		
Martinville	UL	low	w/wo	<	
CUM (S-98)	PC	high	w/w		53.0
Longueuil (S-98)	PC	low	w/w	9.9	15.5

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization
W: winter
S: summer

<: result below detection limit
Blank box: parameter not measured

(1): Sum of 8 Group 1 PAHs at all treatment plants, except for the summer results at Châteauguay, CUO, CUQ, Cookshire, Farnham and La Prairie, and winter result at Martinville, where it is the sum of 16 Group 1 PAHs (see text).

(2): Mean concentration calculated from samples of days 1 and 3 only because day-5 sample was overloaded with organic matter, which was causing interference with the analytical method.

TABLE 3.14: MEAN CONCENTRATIONS OF GROUP 2 PAHS (WINTER AND SUMMER)

Treatment plant	Characteristics			Winter (Group 2 PAHs in ng/L)							Summer (Group 2 PAHs in ng/L)						
	TT	II	Deph W/S	Acena-phthene	Anthra-cene	Fluoran-thene	Fluo-rene	Naph-thalene	Phenan-threne	Pyrene	Acena-phthene	Anthra-cene	Fluoran-thene	Fluo-rene	Naph-thalene	Phenan-threne	Pyrene
Farnham	AS	high	wo/w	<	<	5.9	2.4	11.4	7.1	17.7	<	<	8.0	3.9	3.7	26.0	10.7
La Prairie	AS	high	wo/wo	2.7	0.2	4.1	6.5	23.9	5.6	7.0	<	<	9.5	7.1	31.1	19.0	15.3
Magog	AS	high	w/w														
CUO	AS	low	w/w								<	1.1	5.2	6.0	38.0	14.0	25.7
Jonquière	AS	low	wo/wo								0.8	<	3.8	2.0	8.2	6.9	8.3
Châteauguay	BF	low	wo/w								5.5	1.0	11.4	14.0	63.7	34.0	13.3
CUQ (East plant)	BF	low	wo/wo	24.7	3.3	14.8	53.9	267.1	87.2	39.3	14.9	3.4	21.0	35.3	158.7	50.7	26.7
Cookshire (1)	AL	high	wo/wo								<	<	6.0	2.4	<	29.0	30.5
St-J.-de-Beauce	AL	high	wo/w								1.1	<	4.0	5.2	5.9	30.7	5.6
Warwick	AL	high	wo/w														
Saint-Gédéon	AL	low	wo/wo								<	<	5.2	3.1	4.9	10.4	4.6
Sawyerville	AL	low	wo/w														
Martinville	UL	low	w/wo	<	<	5.9	2.0	38.3	16.0	2.7							
CUM (S-98)	PC	high	w/w								38.3	16.0	44.0	46.7	543.3	118.7	40.0
Longueuil (S-98)	PC	low	w/w	22.3	3.6	11.9	49.5	308.4	70.5	13.7	14.3	4.5	7.9	18.7	570.0	55.0	10.8

Treatment type (TT):

AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
w: with dephosphatization
wo: without dephosphatization
W: winter
S: summer

<: result below detection limit
Blank box: parameter not measured

(1): Mean concentration calculated from samples of days 1 and 3 only because day 5 sample was too overloaded with organic matter, which was causing interference with the analytical method.

3.3.4.3 *Chlorinated dioxins and furans*

Usually, compounds analogous to dioxins are found as complex congener mixtures in the environment and have a similar mode of action (Neal, 1985). For this reason, the concept of "toxic equivalence" (TE) was introduced to facilitate their evaluation. The 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) is used to estimate the relative toxicity of dioxins and furans. The concentrations presented in Table 3.15 represent the sum of the 17 specific chlorinated dioxin and furan congeners analysed, expressed as toxic equivalents of 2,3,7,8-TCDD. Complete results for the different congeners and homologue groups are given in Appendix 13; the table of toxic equivalents of the 17 congeners is provided in MENV (1998).

TABLE 3.15: MEAN CONCENTRATIONS OF CHLORINATED DIOXINS AND FURANS (WINTER AND SUMMER)

Treatment plant	**Characteristics**			**Chlorinated dioxins and furans (pg/L)** (1)	
	TT	**II**	**Deph W/S**	**Winter**	**Summer**
Farnham	AS	high	wo/w		0.147
La Prairie	AS	high	wo/wo	0.012	0.014
Magog	AS	high	w/w		
CUO	AS	low	w/w		0.011
Jonquière	AS	low	wo/wo		0.029
Châteauguay	BF	low	wo/w		0.049
CUQ (East plant)	BF	low	wo/wo	0.038	0.130
Cookshire	AL	high	wo/wo		2.624
Saint-Joseph-de-Beauce	AL	high	wo/w		0.081
Warwick	AL	high	wo/w		
Saint-Gédéon	AL	low	wo/wo		0.469
Sawyerville	AL	low	wo/w		
Martinville	UL	low	w/wo	0.018	
CUM (S-98)	PC	high	w/w		0.268
Longueuil (S-98)	PC	low	w/w	0.038	0.319

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization
W: winter
S: summer

Blank box: parameter not measured

(1): Mean concentrations were calculated from daily values of the sum of 17 specific congeners of chlorinated dioxins and furans expressed as toxic equivalents of 2,3,7,8-TCDD.

3.3.5 Pesticides

Forty-six pesticides were analysed at the two treatment plants studied. Of these pesticides, nine herbicides and six insecticides were detected in at least one sample from both plants. Among those more likely to be found because of their use in urban settings, seven pesticides were detected at the effluent of the two treatment plants. The herbicides 2,4-D, mecoprop and dicamba figure in the commercial mixture for urban lawn treatment (residential lawns, parks, golf courses, etc.) The insecticides diazinon, carbaryl, malathion and chlorpyrifos were also detected. Table 3.16 lists the pesticides detected at the CUM and Longueuil plants and the frequency at which they were detected. The list of all the pesticides analysed may be found in Appendix 14.

TABLE 3.16: DETECTION FREQUENCY OF PESTICIDES IN SAMPLES COLLECTED AT CUM AND LONGUEUIL PLANTS

Pesticide	**Detection frequency (%)**	
	CUM (1)	**Longueuil** (2)
Herbicide		
2,4-D	85.7	91.7
Mecoprop	86.2	91.7
Dicamba	65.5	91.7
Bentazone	3.3	0
MCPB	0	33.3
Atrazine	90.0	66.7
Deethyl-atrazine (DEA)	13.3	8.3
Deisopropyl-atrazine (DIA)	16.6	0
Metolachlor	43.3	66.7
Dimethenamide	3.3	25.0
Diuron	20.0	0
Insecticide		
Diazinon	23.3	66.7
Carbaryl	70.0	16.7
Malathion	13.3	50.0
Chlorpyrifos	36.7	33.3
Dimethoate	0	8.3
Carbofuran	0	8.3

(1): Frequency calculated from 30 composite samples drawn on different days.

(2): Frequency calculated from 12 composite samples drawn on three inconsecutive days at the rate of four samples a day.

3.3.5.1 Pesticides detected in the CUM treatment plant effluent

Twelve pesticides were detected in the CUM treatment plant effluent. The mean concentrations obtained using the results of two or three consecutive sampling days are given in Table 3.17. Complete daily results are included in Appendix 15.

Among the four most frequently detected herbicides (Table 3.16), three are associated with lawn treatment (2,4-D, mecoprop and dicamba). The four other herbicides detected are atrazine, metolachlor, diuron and dimethenamide, including deethyl-atrazine (DEA) and deisopropyl-atrazine (DIA), both atrazine degradation products. These products are used in field crops such as corn. The detection of such products in the CUM's effluent is probably due to atmospheric transport of substances from agricultural areas surrounding the Montreal region. Although 2,4-D, mecoprop and dicamba are also used in agriculture, their detection frequency and the higher mean concentrations measured in this study, compared to low atrazine and metolachlor concentrations, point to their use on urban lawns.

Carbaryl was the insecticide most frequently detected (70% of samples). Its detection in May and June suggests use on residential apple trees and fruit trees. Later in the season, carbaryl may be used to eliminate various insects from gardens or to rid lawns of white grubs (lily beetles). It also figures in cat and dog flea shampoos. Chlorpyrifos and diazinon can be used against various lawn insects (ants, spiders, earwigs, etc.). Malathion is registered for controlling certain insects and mites on ornamental plants (trees, shrubs, and flowers) and in gardens.

Dichlorvos was also detected in 63.3% of the samples, but because it was also detected in the control sample, the results were rejected.

TABLE 3.17: MEAN CONCENTRATIONS OF PESTICIDES DETECTED AT THE CUM PLANT

Pesticide	Mean pesticide concentrations [(1)] (μg/L)										
	May 17-19	May 25-27	June 31-2	June 7-9	June 14-16	June 21-22	June 28-29	July 5-7	July 12-14	July 20-22	July 26-27
Herbicide											
2,4-D	0.34	0.26	0.33	0.06	0.22	0.22	0.47	0.24	0.07	<	0.12
Mecoprop	0.41	0.24	0.34	0.21	0.08	0.20	0.53	0.35	0.10	<	0.07
Dicamba	0.05	0.07	0.06	<	0.08	0.23	0.12	0.66	<	<	<
Bentazone	<	<	<	<	<	0.06	<	<	<	<	<
Atrazine	0.86	0.07	0.04	0.09	0.09	<	0.07	0.24	0.04	0.05	0.07
DEA	<	<	<	<	<	<	<	0.46	0.11	<	<
DIA	<	<	<	<	<	<	<	0.04	<	0.33	<
Metolachlor	0.04	0.08	0.02	<	<	<	0.08	0.10	<	<	<
Dimethenamide	<	<	<	<	<	<	<	<	<	<	<
Diuron	<	<	<	<	<	<	0.31	<	<	<	<
Insecticide											
Diazinon	<	0.02	0.02	0.05	<	<	0.03	<	<	0.02	<
Carbaryl	<	0.04	0.09	0.08	0.05	0.05	0.03	<	<	<	<
Malathion	<	<	0.03	<	<	0.02	<	<	<	<	<
Chlorpyrifos	<	0.03	0.02	<	<	<	<	0.02	<	<	<
Dichlorvos	*	*	*	*	*	*	*	*	*	*	*

(1): Mean concentrations calculated from results of samples drawn on 2 or 3 consecutive days, as applicable.
*: Result rejected.
<: Result below detection limit.

3.3.5.2 *Pesticides detected at the Longueuil treatment plant effluent*

Thirteen pesticides were detected in the effluent of the Longueuil treatment plant. The mean concentrations obtained from the results of four compound samples collected the same day during a heavy rainfall are shown in Table 3.18. Complete results are given in Appendix 15.

Pesticide concentrations detected at the Longueuil plant are generally higher than at the CUM plant. This could be due to the fact that the samples were collected during a rainfall rather than during regular intervals, or to the characteristics of the urban environment (e.g. proportion of residential lawns in the area, parks, and golf courses).

TABLE 3.18: MEAN CONCENTRATIONS OF PESTICIDES DETECTED AT THE LONGUEUIL PLANT

Pesticide	**Mean pesticide concentrations $^{(1)}$ (µg/L)**		
	May 19	**June 28**	**September 7**
Herbicide			
2,4-D	3.10	0.42	0.41
Mecoprop	3.10	0.36	0.46
Dicamba	0.32	0.05	0.03
MCPB	<	<	0.06
Atrazine	0.16	0.10	<
Deethyl-atrazine (DEA)	<	<	<
Metolachlor	0.11	0.11	<
Dimethenamide	<	<	<
Insecticide			
Diazinon	0.11	0.04	<
Carbaryl	0.04	<	<
Malathion	0.10	<	<
Chlorpyrifos	0.04	0.07	<
Dimethoate	0.04	<	<
Carbofuran	<	<	<

(1): Mean concentrations calculated from results of 4 composite samples drawn on a single day during 3 different rainfall events.

<: Result below detection limit.

Those products most frequently detected were the herbicides 2,4-D, mecoprop and dicamba. Just as with the CUM treatment plant, the presence of herbicides associated with field crops was also reported in the Longueuil plant effluent.

Many insecticides were also detected: diazinon, carbaryl, malathion, chlorpyrifos, dimethoate and carbofuran. The potential uses for the first four insecticides have already been mentioned. Dimethoate and carbofuran can be used in a number of agricultural and urban applications. However, in this case, it is difficult to pinpoint the source because they were detected only once.

3.3.5.3 Relation between measured pesticide concentrations and flow rate

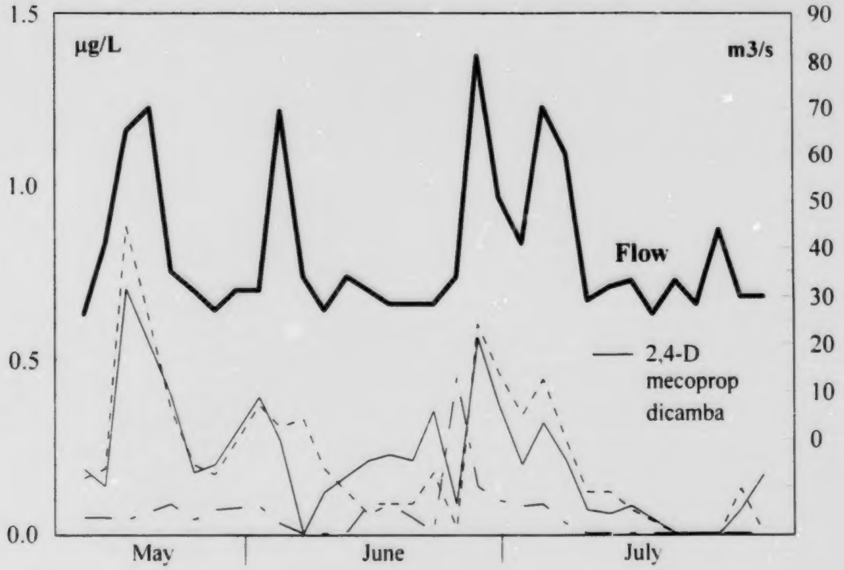
An analysis of the results shows a correlation between measured pesticide concentrations and the flow rate recorded at the treatment plants. As mentioned in Section 2.4.1.3, such a correlation was expected and corroborates the conclusions of other studies carried out in Canada and the U.S.

Figure 3.1 shows the relationship between maximum flow rates recorded and the concentration of six pesticides measured in the 30 samples collected at the CUM plant in 1999. Figure 3.2 shows this same information for the four samples collected May 19, 1999 at the Longueuil plant. Concentrations of the various pesticides tend to be higher during rainfall events, when flow rates are greater at the plant. The correlation, however, seems more obvious for herbicides than for insecticides. During the same rainfall, insecticide concentrations do not always follow the flow rate curve (Figure 3.1 at the CUM and June 28, 1999, at Longueuil [results not shown]).

The type of pesticide present and the increase in concentration during a rainfall coincide with the observations of Struger and Ripley (Government of Canada, 2000), and Struger *et al.* (1994), with regard to the presence of urban-origin pesticides in watercourses and runoff water retention lagoons in the cities of Toronto, Hamilton and Guelph, Ontario.

In the United States, two studies conducted by the United States Geological Survey deal with watercourses draining urban areas: Dallas, Texas and Denver, Colorado These studies report the presence of carbaryl (Land *et al.*, 1998; Kimbrough and Litke, 1993), chlorpyrifos and diazinon (Land *et al.*, 1998). The authors indicated that concentrations increase as the flow rate does.

FIGURE 3.1: RELATION BETWEEN MAXIMUM FLOW RATES AND CONCENTRATIONS OF CERTAIN PESTICIDES AT THE CUM PLANT IN 1999


HERBICIDES

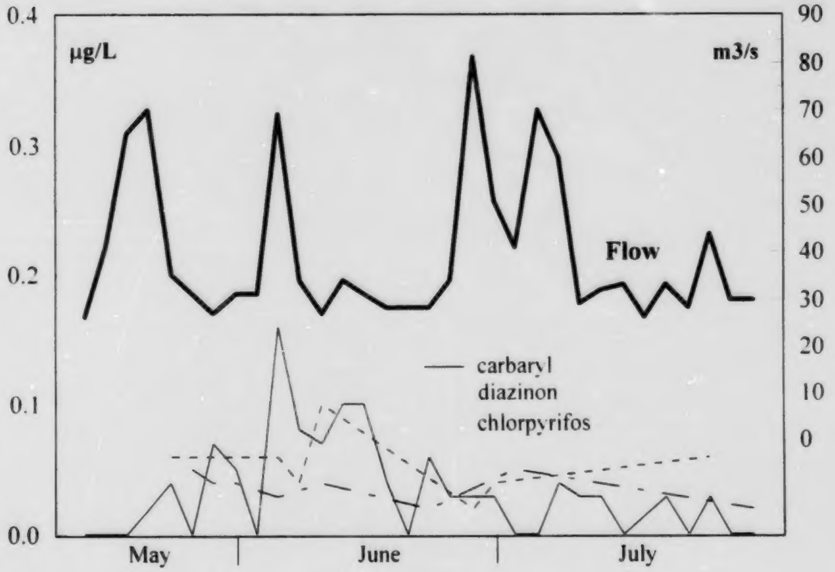
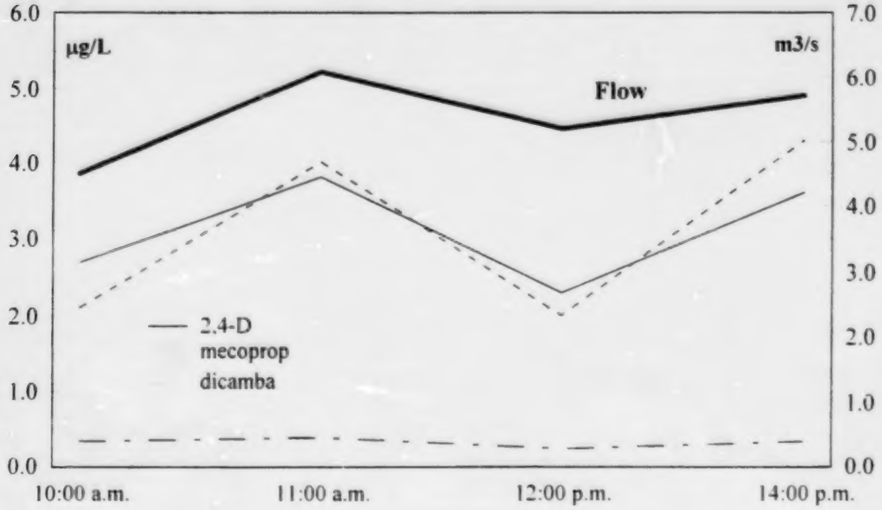
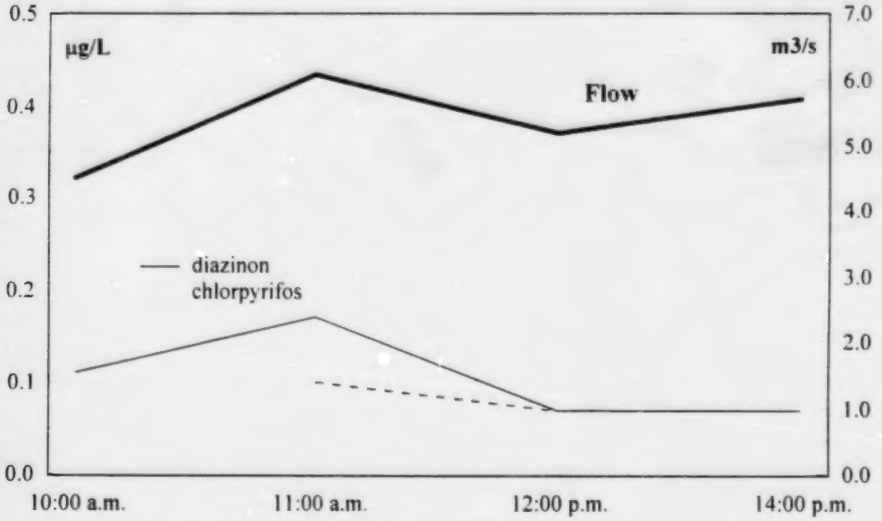

INSECTICIDES

FIGURE 3.2: RELATION BETWEEN FLOW RATES AND CONCENTRATIONS OF CERTAIN PESTICIDES AT THE LONGUEUIL PLANT MAY 19, 1999

HERBICIDES



INSECTICIDES



3.3.6 Quality control

The 30 municipal effluent characterizations produced more than 10 000 physico-chemical analyses. All the analyses were carried out in compliance with the quality requirements of the program contained in the SLV 2000 general characterization guide (SLV 2000, 1995) and the SCA-01 guide of the CEAEQ certification service. They were performed by different private and government laboratories, all certified by the MENV.

The results obtained by the private laboratories who performed the analyses of conventional physico-chemical parameters (PCPs) and metals for the 1996–97 sampling period, along with VOCs and SVOCs, were the subject of specific quality-assessment reports (one report per treatment plant per season of the year). For further details on the subject, consult one of the 30 scientific and technical reports published by Environment Canada's St. Lawrence Centre (Roberge, S, 1996 to 1999).

For the other analyses conferred to the CEAEQ: metals during the 1998–99 sampling period, trace levels of organic substances (PCBs, PAHs, chlorinated dioxins and furans), surfactants and pesticides, the results were all accepted, with the exception of the dichlorvos pesticide results at the CUM plant and the nonionic surfactants at the Sawyerville plant in winter. When they were deemed doubtful, these analyses were repeated until the results complied with requirements.

All results that did not comply with the quality standards were rejected (identified by asterisks in the results tables or by a note of caution).

4 INTERPRETATION OF THE RESULTS

Two complementary tools are usually used to assess the quality of wastewater discharged to the aquatic environment: the overall toxicity criteria for toxicity tests, and the quality criteria for surface water defined for physico-chemical substances.

Toxicity tests offer certain advantages to the quality assessment of effluents. Among other things, they take account of contaminant bioavailability , chemical interactions among contaminants, and the toxicity of substances that are not analysed or not suspected.

The water quality criteria defined for the protection of aquatic life are based on numerous (eco)toxicological studies and cover a wider variety of "effect parameters" and aquatic species. In addition, quality criteria are defined not only for aquatic life, but also to prevent the contamination of aquatic organisms consumed by humans and terrestrial fauna.

Each of these two tools has its own interpretative limits, but their combined use provides for a more complete assessment of the potential effects of effluent wastewaters discharged to an aquatic environment (MENV, 1998).

The results of the toxicity tests and the physico-chemical analyses presented in the preceding chapter are interpreted in this section so as to evaluate the toxic potential of effluents before they are diluted in the aquatic environment. To this end, the results of the toxicity tests are first compared to the overall toxicity criteria, expressed in toxicity units (TU), after which the results of the physico-chemical analyses are compared to the water quality criteria, expressed in concentration units of chemical substances.

Finally, an analysis is carried out to determine whether one or more substances may be responsible for the toxicity measured and to evaluate the effects of season, treatment process type, the presence of industry and chemical phosphorus removal on the toxicity of effluents.

4.1 Comparison of Toxicity Test Results with Overall Toxicity Criteria

4.1.1 The toxicity tests of the approach for the protection of the aquatic environment

The toxicity tests employed in the MENV approach for the protection of the aquatic environment evaluate the toxic potential of an effluent for aquatic life using the overall toxicity criteria presented in the document, *Critères de qualité de l'eau de surface au Québec (*quality criteria for runoff water in Quebec*)* (MENV, 1998); that is:

- 1 TUa for acute toxicity (*O. mykiss* and *D. magna*)
- 1 TUc for chronic toxicity (*P. promelas*, *C. dubia* and *S. capricornutum*).

Toxicity tests are good indicators of the probable effects of an effluent on the environment (U.S. EPA, 1991). Any toxicity test result exceeding the value of 1 TUa indicates that the effluent can severely, and in a short time, harm aquatic organisms exposed thereto. In addition, when an effluent exceeds the value of 1 TUc, it is an indication of its toxic potential for aquatic organisms were it to be found at such a concentration in the environment. This exercise thus provides a theoretical appreciation of the potential toxicity of an effluent for the receiving environment.

Table 4.1 presents the number and percentage of treatment plants and samples having obtained at least one result that exceeds the overall toxicity criteria of 1 TUa and 1 TUc. Since the criteria are composed of a single unit, the tables are simply a compilation of the toxicity test results that are greater than 1 TU (tables 3.2-W, 3.2-S, 3.3-W, 3.3-S).

4.1.1.1 Acute toxicity

RAINBOW TROUT (*O. mykiss*)

Of the valid results obtained with the samples drawn under winter operating conditions, four treatment plants out of 14 (29%) exhibited acute toxicity (> 50% mortality) for rainbow trout in at least one of the three daily samples (Cookshire, Saint-Gédéon, Saint-Joseph-de-Beauce and Warwick) (tables 3.2-W and 4.1). Among the ten other treatment plants, eight presented no sign of acute toxicity, while two showed mortality percentages below 50% (Sawyerville and CUQ).

In summer, the effluents of three plants out of 13 (23%) exhibited acute toxicity (Châteauguay, La Prairie and Longueuil [1998 and 1999]) and three plants had at least one mortality percentage below 50% (CUM [1998 and 1999], Jonquière and Saint-Gédéon) (tables 3.2-S and 4.1). The other seven plants showed no signs of acute toxicity.

CLADOCERAN (*D. magna*)

Only the Cookshire treatment plant exhibited acute toxicity (over 50% mortality) to *D. magna* in winter. As for the samples drawn in summer, 23% of the plants (3 plants out of 13) exhibited toxicity (Cookshire, Longueuil [1998] and Saint-Joseph-de-Beauce).

TABLE 4.1: NUMBER AND PERCENTAGE OF TREATMENT PLANTS AND SAMPLES EXCEEDING THE OVERALL TOXICITY CRITERIA FOR THE TOXICITY TESTS USED IN THE MENV APPROACH FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT (WINTER AND SUMMER)

Toxicity test	**Treatment plants exceeding the overall toxicity criteria** [(1)]						**Samples exceeding the overall toxicity criteria** [(2)]					
	Winter		**Summer**		**Total**		**Winter**		**Summer**		**Total**	
	Number	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Acute toxicity (exceedance of the 1 TUa overall toxicity criterion)												
1. Rainbow trout (*O. mykiss*)	4/14	29	3/13	23	7/15	47	10/37	27	8/44	18	18/81	22
2. *Daphnia magna*	1/15	7	3/13	23	3/15	20	3/45	7	7/46	15	10/91	11
Total (1 and 2 combined)	4/15	27	5/13	38	7/15	47	13/82	16	15/90	17	28/172	16
Chronic toxicity (exceedance of the 1 TUc overall toxicity criterion)												
1. *Selenastrum capricornutum*	2/15	13	0/13	0	2/15	13	2/15	13	0/15	0	2/30	7
2. Fathead minnow (*P. promelas*)	14/15	93	9/13	69	14/15	93	14/15	93	9/13	69	23/28	82
3. *Ceriodaphnia dubia*	7/15	47	9/13	69	12/15	80	7/15	47	11/15	73	18/30	60
Total (1 to 3 combined): > 1 TUc	14/15	93	11/13	85	14/15	93	23/45	51	20/43	47	43/88	49
> 10 TUc	5/15	33	6/13	46	7/15	47	5/45	11	7/43	16	12/88	14
> 30 TUc	1/15	7	1/13	8	1/15	7	1/45	2	1/43	2	2/88	2

(1): A plant is included in the total when at least one result exceeds the overall toxicity criterion. A plant is not included in the total when all samples tested for a species are rejected at that plant.

(2): A sample is not included in the total when its result is rejected.

To summarize, seven of 15 stations (or 47%) obtained at least one acute toxicity result with more than 50% mortality in one or another undiluted whole effluent sample analysed at each plant (all seasons and species included). Under winter operating conditions, only four plants out of 15 (27%) did not meet the acute criterion for overall toxicity of 1 TUa for at least one of the two toxicity tests (*D. magna* and *O. mykiss*). In summer, five of 13 plants (38%) obtained results exceeding 1 TUa. As a percentage of the number of samples, 22% were toxic to rainbow trout and 11% were toxic to *Daphnia magna*.

These results, together with the low amplitude of exceedances of the 1 TUa quality criterion, seem to indicate that the municipal treatment plants in Quebec exhibit a low acute lethal toxicity to aquatic organisms. Only two plants — Cookshire (winter and summer) and Longueuil (summer) — exhibit values well above 1 TUa, which may indicate potential toxicity for organisms living immediately downstream of the plant outfalls.

For purposes of comparison, 56% of the samples examined in assessing the toxicity of ten municipal effluents in Ontario (Orr *et al.*, 1992) were toxic to rainbow trout, and 27% were toxic to *Daphnia magna;* the present study shows percentages of 22% and 11%, respectively. These differences are mainly due to the fact that treatment plants in Quebec do not employ chlorine treatment to disinfect wastewaters, while such was the case in Ontario in 1992.

4.1.1.2 Chronic toxicity

S. capricornutum ALGAE

Of the 30 characterizations (winter and summer), only two treatment plants monitored under winter conditions exhibited chronic toxicity to algae (Cookshire and Sawyerville). All other effluent samples had a stimulating effect on algal growth, probably due to the abundant presence of nutrients in the municipal effluents (see tables 3.3-W, 3.3-S and 4.1). A recent study carried out on the effluents of 18 municipal treatment plants in Australia showed similar results, with an absence of toxicity to the algae *S. capricornutum* (Bailey *et al.*, 1999).

However, the stimulated algal growth observed in the winter samples is amplified in comparison with what might actually be observed in an aquatic environment, since the temperature of the test water was 24°C, while the temperature of the watercourse in winter is ≥ 4°C.

An increase in algal growth is not necessarily a positive effect on an aquatic environment. For example, excessive proliferation of algae and aquatic plants may lead to a dramatic decrease in dissolved oxygen at night (plant respiration) and thereby be detrimental to aquatic life.

FATHEAD MINNOW (*P. promelas*)

In winter, 93% of all plant effluents (14 of 15 plants) presented significant chronic toxicity in the fathead minnow tests (> 1 TUc). For the tests carried out on samples drawn in summer, the effluent of 9 plants out of 13 (or 69%) had an effect on the survival or growth of *P. promelas* larvae. Martinville is the only treatment plant where samples recorded no toxicity, whether they were drawn in winter or in summer. Except for the CUM plant in winter, which exhibited a questionable result above 100 TUc, six plants showed results > 10 TUc: CUQ, Longueuil and Saint-Joseph-de-Beauce in winter, as well as Cookshire, CUM and Jonquière during the summer characterization campaign. The CUM winter result is considered unreliable because of the great variation in the results obtained from one sample to another.

CLADOCERAN (*C. dubia*)

The effluents of 7 of 15 plants (47%) in winter and 9 of 13 (69%) in summer had significant chronic effects on *C. dubia*. The CUO and Martinville plants are the only plants for which the effluent had no effect in winter or summer. The highest responses (> 10 TUc) were recorded at Cookshire in winter, followed by Jonquière, Longueuil (1998), Saint-Gédéon and Saint-Joseph-de-Beauce in summer.

In summary, with the exception of a single plant — that of Martinville — the effluents of all treatment plants exceeded the TUc chronic toxicity criterion in at least one of the three tests. All the effluents characterized in winter as well as in summer had one or more effects on the survival, growth or reproduction of *S. capricornutum*, *P. promelas* and *C. dubia*. However, the exceedances are small in the majority of cases, since only 14% of the samples (12 out of 88) showed a result above 10 TUc.

In terms of numbers, this corresponds to seven plants out of 15 (47%) having obtained at least one result above 10 TUc (all seasons and tests combined). These plant effluents would be potentially harmful if the receiving environment had a weak streamflow compared to that of the effluent. Only one of the effluents presented a result above 30 TUc.

Almost all samples had a stimulating effect on algal growth. This positive response in the *S. capricornutum* was not quantified in terms of toxic units, but it is nonetheless indicative of the potential harm for aquatic life, as discussed above.

For comparison purposes, the toxicity monitoring of 39 municipal effluent samples since 1987 in Maryland showed that 54% of the effluents exhibited chronic toxicity before dilution. When taking into account the dilution factor allocated to each discharge, only six effluents still exhibited a potential chronic toxicity, and only because these effluents were discharged into very small or intermittent watercourses (Fisher *et al.*, 1998).

Another study, Orr *et al.* (1992), indicates that, of the 80 samples of effluents drawn from ten municipal treatment plants in Ontario, 69% were chronically toxic to fathead minnow and 56% to *C. dubia*, compared to 82% and 60%, respectively, in the present study. However, the samples in the Ontario study were treated to reduce their toxicity due to chlorine and ammonia nitrogen.

4.1.2 The toxic print of the PEEP Index

No threshold or criterion has yet been established to indicate a worrisome or harmful level relative to toxic prints of the PEEP Index.

However, the results indicate that the effluents of Saint-Joseph-de-Beauce (in winter and in summer), Sawyerville (in winter) and Martinville (in winter) stand apart from the rest due to their high toxic prints (see Table 3.5). The latter exceed the detection limit (i.e. 0.1 ATU.bvu^{-1}) by a factor of approximately 550 to 900. The effluents of the Cookshire plant (winter and summer) are next, followed by Farnham's (winter), with respective toxic prints of 34.1, 17.0 and 15.8 ATU.bvu^{-1}, or approximately 340 to 160 times the detection limit. As for the remaining treatment plants, the exceedances range from 1 (i.e. undetectable toxicity) to 80.

The toxic prints of Sawyerville and Martinville in winter are surprising, considering the very low industrial inputs at these treatment plants. The results of the toxicity tests performed at both these sites indicate that only genotoxicity to *E. coli* contributed to the toxic print.

The genotoxic responses in *E. coli* also contributed to high toxic prints at several other plants, particularly at Saint-Joseph-de-Beauce, Cookshire and Farnham (winter and summer in all cases). In addition, the test with *E. coli* seems to have been the most sensitive to municipal effluents since positive responses were recorded at 11 of the 15 plants sampled under winter conditions and at 6 of the 13 plants in summer (Table 3.4). All the positive samples contained direct-acting genotoxic agents; that is, contaminants that require no metabolic activation to produce their effects, except at Farnham in summer. Many of these plants also showed effects following a five-day aeration of the sample, which may suggest that the agents capable of altering bacterial DNA are persistent, at least in the short term, in municipal wastewaters.

The test with *C. dubia* was the most sensitive of all, particularly in summer, with more than half of the effluents having caused significant reproductive inhibition. Five samples, those from Cookshire in winter as well as La Prairie, Saint-Joseph-de-Beauce, CUM and Longueuil in summer, were lethal to this cladoceran.

Only a few samples of the two remaining tests showed phytotoxic responses with the growth test of the algae *S. capricornutum* or bioluminescence inhibition responses in *V. fischeri*. Rather, as discussed in Section 4.1.1.2, tests on *S. capricornutum*, and to a lesser extent *V. fischeri*, indicated significant stimulation throughout the test samples, suggesting the presence of nutrients in the municipal wastewaters.

Positive responses were yielded by the samples drawn at Cookshire throughout testing, with the exception of the test with *V. fischeri* in winter and *S. capricornutum* in summer. The responses suggest a genotoxic potential ranging from marginal to moderate. These results indicate that wastewater at this plant can affect more than one trophic level in the food chain — that is, the decomposers, and both the primary producers and consumers.

4.2 Comparison of Results of Physico-chemical Analyses with Water Quality Criteria

This section compares the results of the physico-chemical analyses with the MENV water quality criteria (1998).

Water quality criteria integrate all the information available on potentially toxic concentrations for various uses of water. There may be several quality criteria for a single substance and each of these criteria is defined for the purpose of protecting a specific use of water (MENV, 1998).

In light of the objectives of this study, three uses were selected to interpret the analytical results: aquatic life, the consumption of fish, shellfish and crustaceans by humans, and by piscivorous wildlife. These three uses are present or potentially present in all watercourses in Quebec. They are respectively represented by the chronic water quality criterion for the protection of aquatic life (CCAL), the water quality criterion for the prevention of contamination of aquatic organisms (CPCO), and the water quality criterion for the protection of piscivorous wildlife (CPPW)

The exceedances of quality criteria for all substances analysed are presented in sections 4.2.1 and 4.2.2 below. The ratio *mean concentration:toxicity criterion (CCAL, CPCO* and *CPPW)* was calculated for every substance at every plant and for every season. Only ratios ≥ 1 are presented in the tables.

The ratio value obtained for a given substance indicates the extent to which the concentration measured in the undiluted effluent exceeds the quality criteria. A ratio greater than 1 provides a theoretical appreciation of the toxic potential of the effluent were that concentration to be found as such in the environment. However, since the effluent is diluted in the receiving water, the exceedance value for quality criteria will be lower in the natural environment, or even nil, depending on the case, in relation to the specific characteristics of each receiving environment. Consequently, any amplitude of exceedance of the quality criteria below 10 indicates, as a general rule, a lower degree of concern.

4.2.1 Protection of aquatic life

Chronic water quality criteria for the protection of aquatic life (CCAL) are defined to ensure the long-term protection of all aquatic organisms. They represent the highest permissible concentration of a substance that will not be detrimental to aquatic organisms (and their offspring) exposed to it on a daily basis throughout their lifetimes. The exceedance of a CCAL at the effluent gives an indication of the minimal dilution required for the effluent/aquatic environment mixture to reach a concentration below the threshold of potential effect.

There are CCALs for a number of substances, most of which are related to the most sensitive uses of the water.

4.2.1.1 *Conventional physico-chemical parameters*

Tables 4.2-W and 4.2-S show the amplitudes of exceedance of CCALs obtained at the various treatment plants for conventional physico-chemical parameters (PCP).

The first three parameters (BOD_5, SM and P_T) are among the main contaminants present in domestic and agri-food industry wastewater, and are used in the design of municipal treatment plants. They are present in large quantities in municipal wastewaters and their removal varies in relation to the treatment process in place. It is therefore possible to observe frequent CCAL exceedances for these substances, although they have no direct toxic effects on the receiving environment.

BOD_5

The results obtained in winter at seven plants were rejected due to a sample contamination problem. Those exceedances that could be calculated for this parameter are generally of low amplitude (1.3 to 14), and by and large indicate a good performance on the part of the treatment plants. Both values > 10 were obtained in summer at plants where wastewater undergoes physico-chemical treatment; the absence of biological treatment explains these results. In the case of the aerated lagoons, exceedances are greater in winter than in summer, particularly at the three plants with heavy industrial inputs (Cookshire, Saint-Joseph-de-Beauce and Warwick). These results are representative of the efficiency expected of aerated lagoons, which is known to be better in summer. The lower exceedances are obtained at the activated sludge plants.

TABLE 4.2-W: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR CONVENTIONAL PHYSICO-CHEMICAL PARAMETERS (WINTER)

Treatment plant (winter)	Characteristics			Exceedances of CCAL for conventional physico-chemical parameters										
	TT	II	Deph	BOD_5	SM	P_T	NH_3 - NH_4^+ (1)	NO_2^- (2)	NO_3^-	H_2S (3)	CT	CN	F	Phenolic subst.
Farnham	AS	high	wo	•	1.1	•	1.6	—	—		—	LD	2.3	—
La Prairie	AS	high	wo	•	4.8	•	4.5	—	—		—	LD	1.4	—
Magog	AS	high	with	•	—	•	—	—	—		—	LD	—	—
CUO	AS	low	with	•	11	•	7.2	—	—		—	LD	—	
Jonquière	AS	low	wo	1.3	—	10	2.7				—	LD	—	
Châteauguay	BF	low	wo	•	1.1	•	9.7	—	—		1.1	LD	3.7	
CUQ (East plant)	BF	low	wo	10	2.2	53	14				1.4	LD	4.0	—
Cookshire	AL	high	wo	8.3	1.2	50	12				1.6	LD	—	—
Saint-J.-de-Beauce	AL	high	wo	6.0	1.9	53	29				—	LD	—	
Warwick	AL	high	wo	5.7	2.2	87	15				—	LD	—	
Saint-Gédéon	AL	low	wo	2.0	—	58	12				—	LD	—	
Sawyerville	AL	low	wo	2.0	—	50	12				—	LD	—	
Martinville	UL	low	with	7.7	1.8	40	4.3	—	—	20	—	—	—	1.2
CUM	PC	high	with	•	3.5	•	7.7	—	—		—	LD	1.2	—
Longueuil	PC	low	with	•	2.9	•	11				—	LD	—	—

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

LD:	limit of detection does not allow for criterion verification
—:	no exceedance of water quality criterion (i.e. exceedance < 1)
•:	result rejected
Blank box:	parameter not measured
( ):	questionable result (quality control): to be considered with caution

(1): Water quality criterion for NH_3-NH_4^+ is determined at each treatment plant from the mean temperature and pH values measured during the chronic toxicity tests.

(2): Water quality criterion for NO_2^- is determined at each treatment plant from the mean chloride concentration measured in the effluent.

(3): Non-ionized H_2S concentration is calculated from the mean concentration of dissolved sulfides measured in the effluent (see text).

TABLE 4.2-S: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR CONVENTIONAL PHYSICO-CHEMICAL PARAMETERS (SUMMER)

Treatment plant (summer)	Characteristics			Exceedances of CCAL for conventional physico-chemical parameters										
	TT	H	Deph	BOD_5	SM	P_T	NH_3 - NH_4^+ (1)	NO_2^- (2)	NO_3^-	H_2S (3)	CT	CN^-	F	Phenolic subst.
Farnham	AS	high	with	1.3	1.0	6.7	—	—	—	LD	—	—	3.1	—
La Prairie	AS	high	wo	1.7	—	19	28	1.0	—	LD	—	—	1.5	—
Magog	AS	high	with											
CUO	AS	low	with	—	—	15	5.7	1.0	—	LD	—	—	—	—
Jonquière	AS	low	wo	—	—	6.4	(2.2)	—	—	LD	—	LD	(—)	—
Châteauguay	BF	low	with	3.0	1.0	22	11	—	—	2.1	—	—	4.6	—
CUQ (East plant)	BF	low	wo	3.7	1.1	42	11	—	—	LD	—	—	3.8	—
Cookshire	AL	high	wo	3.3	1.0	37	7.9	3.0	—	LD	—	—	—	2.0
Saint-J.-de-Beauce	AL	high	with	2.0	3.7	24	(1.3)	100	—		—	26	(—)	—
Warwick	AL	high	with											
Saint-Gédéon	AL	low	wo	—	—	73	(9.5)	2.9	—		—	10	(1.0)	—
Sawyerville	AL	low	with	LD	—	14	2.1		—		—	4.0	—	
Martinville	UL	low	wo	6.0	4.6	29	LD		—		—	LD	—	
CUM (1998)	PC	high	with	7.0	1.8	19	5.7	—	—	4.3	—	4.0	(1.6)	1.0
CUM (1999)	PC	high	with	14	2.0	15	7.1	—	—	30	—	4.0	—	1.8
Longueuil (1998)	PC	low	with	12	2.9	28	11	(—)	—	26	—	LD	(—)	2.0
Longueuil (1999)	PC	low	with	7.7	1.7	19	12	—	—	39	—	—	—	2.0

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

H:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

LD:	limit of detection does not allow for criterion verification
—:	no exceedance of water quality criterion (i.e. exceedance < 1)
*:	result rejected
Blank box:	parameter not measured
( ):	questionable result (quality control); to be considered with caution

(1): Water quality criterion for NH_3-NH_4^+ is determined at each treatment plant from the mean temperature and pH values measured during the chronic toxicity tests.
(2): Water quality criterion for NO_2^- is determined at each treatment plant from the mean chloride concentration measured in the effluent.
(3): Non-ionized H_2S concentration is calculated from the mean concentration of dissolved sulfides measured in the effluent (see text).

SM

SM exceedances were of low amplitude (1.1 to 11) and again indicate the good treatment performance of the plant. The highest value was obtained in winter at the CUO (activated sludge process), but these results are unreliable (see Appendix 2). The 4.8 exceedance obtained in winter at the La Prairie plant (activated sludge) was due to a particularly high single-day result (112 mg/L), probably caused by a loss of sludge. A similar exceedance was obtained in summer at Martinville and can be attributed to the discharge method used during the emptying process, which may draw out algae and sometimes sludge. In the case of aerated lagoons, the only exceedances observed were at the three plants receiving large industrial loads.

TOTAL PHOSPHORUS

The total phosphorus results were rejected at seven plants in winter because the analysis control requirements were not met. Exceedances for this parameter ranged from 6.4 to 87. Exceedances were highest (> 40) at plants that do no chemical dephosphatization, either in winter or year-round. Exceedances at plants that carry out chemical dephosphatization half of the year are lower during the season in which the process is executed, except in the Martinville unaerated lagoons. In this case, the exceedance was greater during spring lagoon emptying (winter conditions) with dephosphatization than during fall emptying without dephosphatization (summer conditions). These results are due to phosphorus, which accumulates yearly in the sludge. Indeed, an effluent characterization with dephosphatization (May 1999) was carried out more than two and a half years after the characterization without dephosphatization (October 1996). In addition, for the first time in 1999, the Martinville plant had to add alum to its unaerated lagoons because its total phosphorus discharge requirements were no longer being respected.

Chemical dephosphatization is required at plants where the receiving environment is sensitive to enrichment (eutrophication). This requirement applies in summer (May 15 to October 15/November 15) or year-round when the discharge is upstream from an area of significant sediment accumulation, such as a lake or a reservoir.

NITROGEN

The CCAL for ammonia nitrogen (NH_3-NH_4^+) varies with temperature and level of pH. To obtain the ratio of mean concentration to CCAL, a quality criterion was calculated for each effluent in relation to temperature maintained during the chronic toxicity tests with replacement water (25°C) and the mean pH measured during the test (Appendix 7).

The greatest exceedances were obtained at the Saint-Joseph-de-Beauce (29) and Warwick (15) aerated lagoons in winter, as well as at the La Prairie activated sludge treatment plant in summer (28). In all three cases, the large organic loads probably come from agri-food plants. At treatment plants with aerated lagoons, the exceedances are all greater in winter, which confirms that nitrification (conversion of ammonia nitrogen into nitrites and then into nitrates by nitrifying bacteria) improves in summer in aerated lagoons.

Nitrites (NO_2^-) and nitrates (NO_3^-) were analysed at seven plants only in winter. For NO_2^-, CCAL varies with chloride concentration. To obtain the ratio of mean concentration to criterion, the CCAL was selected based on the mean chloride concentration measured at each effluent. There were no exceedances of NO_2^- in winter and none of NO_3^- in either season. Only two minor NO_2^- exceedances in summer and one major exceedance were recorded at the Saint-Joseph-de-Beauce plant (100). The latter result can be explained by the incomplete nitrification of ammonia nitrogen due to an increase in the organic load flowing to the lagoons.

HYDROGEN SULFIDE

Non-ionized hydrogen sulfide (H_2S) cannot be measured directly but can be calculated based on the concentration of dissolved sulfides, pH, conductivity and temperature. However, dissolved sulfides were only measured during the 1998–99 campaign. In addition, the method's limit of detection (LD) does not make it possible to verify that the criterion is being met at many plants.

The few exceedances obtained ranged from 2.1 to 39. The highest values were recorded in summer at the CUM and Longueuil plants, which use a physico-chemical treatment, and in winter at the unaerated lagoons of Martinville. These two treatment processes do not include aeration equipment and, without oxygen (anaerobic conditions), hydrogen sulfide is produced.

CHLORIDES

No exceedance of CCAL was recorded for chlorides in summer and cases of exceedances obtained in winter were exceptional and of very low amplitude (1.1 to 1.6). However, it is interesting to note that the concentrations measured in winter seem significantly higher than those measured in summer at the majority of the plants (tables 3.6-W and 3.6-S). This seasonal variation will be discussed further in Section 4.4.1.

CYANIDES

During the 1996–97 campaign (mainly winter results), the mean cyanide concentrations obtained were almost all below the analytical detection limit, which is higher than the quality criterion (CCAL = 0.005 mg/L). During the 1998–99 campaign, the detection limit of the selected analysis method was lower for the majority of plants and only five exceedances were recorded. The greatest CCAL exceedances were obtained at the Saint-Joseph-de-Beauce (26) and Saint-Gédéon (10) plants.

FLUORIDES

There were a few low amplitude exceedances of CCAL for fluorides. At the Farnham, Châteauguay and CUQ plants, the concentrations measured could be explained in part by fluoridation of the drinking water, which is carried out in the municipalities of these three plants.

PHENOLIC SUBSTANCES

During the 1996–97 campaign, a series of phenolic substances were analysed by scanning at seven municipal treatment plants under winter conditions. Several results had to be rejected because of analysis quality control problems, and no other phenolic substance was detected using this method. During the 1998–99 campaign, a colorimetric method was used and only five very low CCAL exceedances (1.2 to 2.0) were recorded (Martinville in winter and Cookshire, CUM [1999] and Longueuil [1998 and 1999] in summer).

TOTAL RESIDUAL CHLORINE
There were no exceedances of the CCAL for total residual chlorine (TRC) at the Magog plant. This parameter does not appear in tables 4.2-W and 4.2-S, since it was only analysed at the Magog plant, and only in winter. TRC concentrations measured at the effluent of this plant were all below the method detection limit of 0.10 mg/L (Appendix 3).

MINERAL OILS AND GREASES
Mineral oils and greases do not appear in tables 4.2-W and 4.2-S because there is no specific quality criterion for these substances. Nevertheless, they can help better define the quality of an effluent.

Mineral oils and greases were detected at the majority of plants (see tables 3.6-W and 3.6-S), but the mean concentrations were all lower than 1.0 mg/L, except at Cookshire in winter, where the mean concentration is much higher (16 mg/L). This result must be considered with some caution, however, because of the lack of quality control in the analytical results.

OTHER PARAMETERS
There are no CCALs for the other conventional physico-chemical parameters analysed (BOD_5, sulfates, hardness, etc.). These parameters do not, therefore, appear in tables 4.2-W and 4.2-S.

4.2.1.2 Metals

CCALs for certain metals (barium, beryllium, cadmium, copper, nickel, lead and zinc) increase with water hardness. The mean hardness measured in the effluent of each plant during the 1998–99 campaign was used to calculate CCALs for these metals. In the case of the three plants that were not sampled in 1998–99, a mean rate of hardness measured in the summer of 2000 was used for the Magog plant (152 mg/L obtained with four samples) and a default value of 100 mg/L served for the other two plants (Sawyerville and Warwick). It is possible that, in the second case, the exceedances of quality criteria for these metals were overestimated because actual hardness is probably greater.

The amplitudes of metal CCAL exceedances are presented in tables 4.3-W and 4.3-S.

TABLE 4.3-W: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR METALS (WINTER)

Treatment plant	Characteristics			Exceedances of CCAL for metals [(1)]																		
(winter)	TT	II	Deph	Al	Sb	Ag	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Hg	Mo	Ni	Pb	Se	V	Zn
Farnham	AS	high	wo	9.0		LD					—	(8.0)		12	4.2	—		—	—	—		—
La Prairie	AS	high	wo	1.0		LD					—	14		1.2	—	—		—	—	—		—
Magog	AS	high	with	4.0		LD					—	(7.5)		(6.5)	3.9	—		—	—	—		—
CUO	AS	low	with	31		20					—	(6.0)		18	11	—		—	(1.1)	—		—
Jonquière	AS	low	wo	2.3		LD					—	—		4.0	—	—		—	—	—		—
Châteauguay	BF	low	wo	—		LD					—	(8.5)		8.7	4.3	—		—	—	—		—
CUQ (East plant)	BF	low	wo	3.4		80					—	2.5		6.7	2.9	—		—	—	—		—
Cookshire	AL	high	wo	2.3		50					—	6.0		14	—	—		—	—	—		1.5
Saint-J.-de-Beauce	AL	high	wo	—		50					—	1.0		3.5	4.1	—		—	—	—		—
Warwick	AL	high	wo	2.3		40					—	—		2.1	1.2	—		—	—	—		—
Saint-Gédéon	AL	low	wo	1.1		30					—	1.0		5.3	—	—		—	—	—		—
Sawyerville	AL	low	wo	—		20					—	—		12	1.6	—		—	—	—		—
Martinville	UL	low	with	2.9	—	—	—	—	—	—	—	—	—	1.1	—	—	—	—	—	—	—	—
CUM	PC	high	with	1.6		LD					—	13		5.6	5.8	—		—	—	(—)		—
Longueuil	PC	low	with	11		LD					—	13		2.9	—	—		—	—	—		—

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization

LD: limit of detection does not allow for criterion verification
—: no exceedance of water quality criterion (i.e. exceedance < 1)
*: result rejected
Blank box: parameter not measured
( ): questionable result (quality control); to be considered with caution

(1): CCALs for Ba, Be, Cd, Cu, Ni, Pb and Zn were calculated using the mean hardness measured at each plant.

TABLE 4.3-S: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR METALS (SUMMER)

Treatment plant	Characteristics			Exceedances of CCAL for metals [(1)]																		
(summer)	TT	II	Deph	Al	Sb	Ag	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Hg	Mo	Ni	Pb	Se	V	Zn
Farnham	AS	high	with	7.9	—	—	—	—	—	—	—	—	—	4.1	1.1	—	—	—	—	—	—	—
La Prairie	AS	high	wo	1.3	—	—	—	—	—	—	—	—	—	1.6	—	—	—	—	—	—	—	—
Magog	AS	high	with																			
CUO	AS	low	with	—	—	—	—	—	—	—	—	—	—	2.2	—	—	—	—	—	—	—	—
Jonquière	AS	low	wo	1.4	—	—	—	—	—	—	—	4.0	—	3.6	—	—	—	—	—	—	—	—
Châteauguay	BF	low	with	6.7	—	4.0	—	—	—	—	—	1.2	—	3.1	—	—	—	—	—	—	—	—
CUQ (East plant)	BF	low	wo	1.7	—	22	—	—	—	—	—	—	—	5.7	2.6	—	—	—	—	—	—	—
Cookshire	AL	high	wo	—	—	—	—	—	—	—	—	10	—	9.9	1.3	—	—	—	—	—	—	—
Saint-J.-de-Beauce	AL	high	with	—	—	—	—	—	—	—	—	2.0	—	2.9	1.7	—	—	—	—	—	—	—
Warwick	AL	high	with																			
Saint-Gédéon	AL	low	wo	—	—	—	—	—	—	—	—	2.5	—	4.7	—	—	—	—	—	—	—	—
Sawyerville	AL	low	with	—		(LD)					—	7.1		—	—	—		—	—	—		—
Martinville	UL	low	wo	—		LD					—	11		—	1.3	—		—	—	—		—
CUM (1998)	PC	high	with	11	—	11	—	—	—	—	—	4.0	—	7.0	—	—	—	—	—	1.8	—	—
CUM (1999)	PC	high	with	8.8	—	7.0	—	—	—	—	—	2.7	—	5.6	—	—	—	—	—	—	—	—
Longueuil (1998)	PC	low	with	30	—	7.0	—	—	—	—	—	13	—	3.6	—	—	—	—	—	—	—	—
Longueuil (1999)	PC	low	with	11	—	—	—	—	—	—	—	2.4	—	1.9	—	—	—	—	—	—	—	—

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

LD:	limit of detection does not allow for criterion verification
—:	no exceedance of water quality criterion (i.e. exceedance < 1)
*:	result rejected
Blank box:	parameter not measured
( ):	questionable result (quality control): to be considered with caution

(1): CCALs for Ba, Be, Cd, Cu, Ni, Pb and Zn were calculated using the mean hardness measured at each plant.

Of the 11 metals analysed during the 1996–97 campaign, no CCAL exceedances were observed for three — cadmium (Cd), mercury (Hg) and nickel (Ni) — both in winter and summer. Also, no CCAL exceedance was observed for the eight metals added to the characterization program of the 1998–99 campaign: antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cobalt (Co), molybdenum (Mo) and vanadium (V). The eight metals for which there were exceedances are presented below.

ALUMINUM

Exceedances of the CCAL for aluminum (Al) were recorded at a majority of plants and for all treatment processes. Among the ten exceedances with the highest amplitudes (ranging from 4.0 to 31), eight were observed at plants that were using aluminum sulfate (alum) for dephosphatization during our sampling. These results suggest a link between aluminum concentrations measured in the effluents and dephosphatization by alum. However, no CCAL exceedances were recorded at the two plants where alum dephosphatization was used in summer: Saint-Joseph-de-Beauce and Sawyerville. Further analysis of the effects of chemical dephosphatization is provided in Section 4.4.3.

For the other plants that do no dephosphatization by alum, it is not possible to confirm whether or not a relationship exists between the aluminum concentrations measured and industrial loading or treatment process.

SILVER

During the 1996–97 campaign, the method detection limit for silver (Ag) was not sensitive enough to verify the CCAL. This means that as soon as a concentration is measured, it exceeds the quality criteria. This is the case with seven plants under winter operating conditions, and the exceedances are significant. However, we have doubts concerning the five results with the highest amplitudes — CUQ (80), Cookshire (50), Saint-Gédéon (30), Saint-Joseph-de-Beauce (50) and Warwick (40) — as they all come from the same laboratory, no source of silver contamination could be identified at the plants, and these results were not confirmed by those obtained in summer using a different, more sensitive analysis method. In addition, no comparison could be made with other studies on municipal treatment plants, since: i) either the metal was not analysed for; ii) the detection limit was clearly higher than the criterion; iii) or the presence of this metal was observed without being quantified (U.S. EPA, 1981; Orr *et al.*, 1992; Burgess *et al.*, 1995).

No link can be established between the silver concentrations measured and industrial loads since the greatest exceedances are found at both plants with heavy industrial inputs and those low inputs.

CHROMIUM

For chromium (Cr), CCAL exceedances were observed for all treatment types whatever the industrial load. Indeed, the most significant exceedances were observed at plants with heavy industrial inputs — that is, La Prairie (14) and CUM (13) in winter — as well as at plants with low industrial input, Longueuil in winter (13) and Martinville in summer (11).

COPPER

As with chromium, exceedances of the quality criteria for copper (Cu) are frequent, with only the Martinville and Sawyerville plants, in summer, recording none. No difference was found between plants with heavy industrial inputs and those with low inputs.

IRON

Iron (Fe) concentrations exceed the criterion in all circumstances (treatment type - industrial load). The two plants that added a product containing iron for dephosphatization — the CUO plant in winter and summer (ferric sulfate) and the CUM plant in winter (ferric chloride) — present the greatest exceedances in winter, with 11 and 5.8, respectively. However, no exceedance was observed in summer at the CUO plant. Exceedances similar to those found at the CUM plant were observed under winter conditions at plants (Farnham, Magog, Châteauguay and Saint-Joseph-de-Beauce) that do not use these products.

LEAD

Only one exceedance of CCAL was recorded for lead (Pb), at the CUO plant. It was of very low amplitude (1.1) and the result is considered questionable because of poor analytical quality control.

SELENIUM

As was the case for lead, there was only a single small exceedance of CCAL (1.8) for selenium (Se) recorded at the CUM plant in the summer of 1998.

ZINC

Here also, a single exceedance of CCAL of very low amplitude (1.5) was observed in winter at the Cookshire plant.

4.2.1.3 *Organic Substances*

Tables 4.4-W and 4.4-S present the amplitudes of CCAL exceedances for the organic substances analysed (except for pesticides, which are presented in the following section) and for which there is a quality criterion. In the case of SVOCs and VOCs, only the substances that exhibited values ≥ 1 are shown in the tables.

TABLE 4.4-W: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR ORGANIC SUBSTANCES (WINTER)

Treatment plant (winter)	Characteristics			Exceedances of CCAL for organic substances								
				SVOCs - VOCs			Surfactants		PAHs			
	TT	II	Deph	Toluene	1,2-Dichlo robenzene	Nitro-benzene	Nonionic	Anionic	Acenaphthene	Fluoranthene	Naphthalene	Phenanthrene
Farnham	AS	high	wo	*	—		67	14	—	—	—	—
La Prairie	AS	high	wo	—	—				—	—	—	—
Magog	AS	high	with									
CUO	AS	low	with									
Jonquière	AS	low	wo									
Châteauguay	BF	low	wo									
CUQ (East plant)	BF	low	wo	15	LD				—	—	—	—
Cookshire	AL	high	wo	—	LD	—	190	53				
Saint-J.-de-Beauce	AL	high	wo									
Warwick	AL	high	wo				38	4.5				
Saint-Gédéon	AL	low	wo									
Sawyerville	AL	low	wo				*	LD				
Martinville	UL	low	with	2.8	LD	—	LD	4.3	—	—	—	—
CUM	PC	high	with	5.4	1.0		48	53				
Longueuil	PC	low	with	—	—				—	—	—	—

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization

LD: limit of detection does not allow for criterion verification
—: no exceedance of water quality criterion (i.e. exceedance < 1)
*: result rejected
Blank box: parameter not measured
( ): questionable result (quality control): to be considered with caution

TABLE 4.4-S: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR ORGANIC SUBSTANCES (SUMMER)

Treatment plant (summer)	Characteristics			Exceedances of CCAL for organic substances								
				SVOCs - VOCs			Surfactants		PAHs			
	TT	II	Deph	Toluene	1,2-Dichlorobenzene	Nitro-benzene	Nonionic	Anionic	Acenaphthene	Fluoranthene	Naphthalene	Phenanthrene
Farnham	AS	high	with	—	LD	—	LD	13	—	—	—	—
La Prairie	AS	high	wo	—	LD	—	LD	5.9	—	—	—	—
Magog	AS	high	with									
CUO	AS	low	with	—	LD	—	LD	2.9	—	—	—	—
Jonquière	AS	low	wo	—	—	—	LD	3.2	—	—	—	—
Châteauguay	BF	low	with	—	LD	—	11	23	—	—	—	—
CUQ (East plant)	BF	low	wo	—	LD	—	13	33	—	—	—	—
Cookshire	AL	high	wo	*	LD	—	LD	11	—	—	—	—
Saint-J.-de-Beauce	AL	high	with	—	—	—	LD	7.0	—	—	—	—
Warwick	AL	high	with									
Saint-Gédéon	AL	low	wo	—	—	—	LD	11	—	—	—	—
Sawyerville	AL	low	with									
Martinville	UL	low	wo									
CUM (1998)	PC	high	with	*	—	1.2	44	57	—	—	—	—
CUM (1999)	PC	high	with				81	44				
Longueuil (1998)	PC	low	with	*	—	—	189	383	—	—	—	—
Longueuil (1999)	PC	low	with				95	79				

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

LD:	limit of detection does not allow for criterion verification
—:	no exceedance of water quality criterion (i.e. exceedance < 1)
*:	result rejected
Blank box:	parameter not measured
( ):	questionable result (quality control): to be considered with caution

SEMI-VOLATILE (SVOCS) AND VOLATILE (VOCS) ORGANIC SUBSTANCES

SVOCs were analysed in the samples of two plants in winter and 11 plants in summer, while VOCs were analysed at seven plants in winter and 11 in summer. For both these families of organic substances, close to 100 parameters were analysed and several substances were detected. However, the majority of the results were rejected because they did not meet analytical quality control requirements. Only the results of four SVOCs in summer and 15 VOCs, in both winter and summer, were accepted. In most cases, one or the other of these 19 substances was detected at only one or two plants (see tables 3.8, 3.9-W and 3.9-S). In addition, an examination of the results found that there is usually a wide variation in concentration between samples of days 1, 3 and 5, and the results obtained in a given season are often not confirmed by those obtained in another.

Although these two scanning analysis methods may be appropriate for industrial effluent characterizations, it appears that, in the case of municipal effluents, they are lacking in specificity and the great number of substances analysed results in a significant loss of resolution during measurement.

Nevertheless, there is a CCAL for 14 of the 19 substances for which the results were accepted, and only two presented exceedances: toluene, with three exceedances in winter at the CUM (5.4), the CUQ (15) and Martinville (2.8) plants, and nitrobenzene, with a single low amplitude exceedance in summer at the CUM plant (1.2). Also, 1,2-dichlorobenzene exhibited a result equivalent to the quality criteria obtained in winter at the CUM plant (1.0).

However, the detection limits for some compounds in the SVOC family could not be used to verify the quality criteria (especially for certain chlorobenzenes and phthalates). For VOCs, the method detection limits are low enough, in most cases, to allow verification that the quality criteria are being met.

NONIONIC AND ANIONIC SURFACTANTS

At those plants where surfactants were analysed (see Table 2.6), nonionic surfactants were detected in just over half of the municipal effluents, while anionic surfactants were detected at all plants, with the exception of Sawyerville in summer. The detection limits of these two methods could not be used to verify the quality criterion, but wherever they were detected, exceedances of the CCAL were quite high for the majority of plants. For the nonionic surfactants, the greatest exceedances were found at the Cookshire (190) and Farnham (67) plants in winter and at the Longueuil (189 and 95) and CUM (81 and 44) plants in summer. In the case of anionic surfactants, the greatest exceedances were found at the Cookshire and CUM plants in winter (exceedance of 53 in both cases) and at the Longueuil (383 and 79) and CUM (57 and 44) plants in summer.

Some of the largest concentrations of nonionic surfactants seem to be linked to the presence of textile mills (Farnham and Cookshire), which is not surprising, since this industry is known to use large amounts of these products (Correia *et al.*, 1994; Environment Canada, 1989; Malo, 1977). The use of surfactants however, is not exclusive to this industry. Very high concentrations of surfactants were found in the effluents of the CUM and Longueuil plants, which receive wastewater from several industrial plants and businesses. The domestic sector is another major source.

PAHs
Chronic water quality criteria for the protection of aquatic life are defined for only four specific PAHs: acenaphthene, fluoranthene, naphthalene and phenanthrene. No exceedance of the CCAL was observed for these substances.

PCBs AND CHLORINATED DIOXINS AND FURANS
Since no chronic water quality criteria for the protection of aquatic life are defined for either PCBs or chlorinated dioxins and furans, these substances do not appear in tables 4.4-W and 4.4-S.

4.2.1.4 Pesticides

Of the 15 pesticides detected at the CUM and Longueuil plants during the summer characterizations of 1999 (Tables 3.17 and 3.18), CCAL exceedances were reported for only three insecticides: diazinon, malathion and chlorpyrifos. Table 4.5 presents the amplitude of CCAL exceedances for the mean concentrations of these three insecticides measured at both plants.

In the case of herbicides, no exceedance of the chronic water quality criteria for the protection of aquatic life was observed for the nine substances detected.

Malathion exceeded the CCAL in two of the four composite samples drawn at the Longueuil plant on May 19, 1999. This corresponds to a mean concentration equivalent to the quality criterion value.

The detection limits of diazinon and chlorpyrifos are approximately ten times greater than the CCAL, and it is therefore impossible to verify that the quality criterion is being met. Consequently, this means that each time these substances are detected, the concentrations exceed the quality criterion. Such is the case for 23% and 37% of the samples at the CUM plant for diazinon and chlorpyrifos, respectively, as well as for 67% and 33% of the samples at the Longueuil plant. The mean concentrations measured exceed the CCAL by a factor of 10 to 55 times for diazinon and by 2.8 to 20 times for chlorpyrifos (Table 4.5).

Other studies have also reported the presence of diazinon in municipal effluents (Amato *et al.*, 1992; Burkhard and Jenson, 1993). It should be noted that the diazinon concentrations detected in the present study are generally lower than those measured in the Burkhard and Jenson study (1993).

TABLE 4.5: AMPLITUDES OF EXCEEDANCE OF CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE (CCAL) FOR PESTICIDES MEASURED AT THE CUM AND LONGUEUIL PLANTS IN 1999

Sample	**Exceedances of CCAL for pesticides**		
	Diazinon	**Malathion**	**Chlorpyrifos**
CUM treatment plant (1)			
May 17-19	LD	—	LD
May 25-27	10	—	8.6
May 31- June 2	10	—	5.7
June 7-9	25	—	2.8
June 14-16	LD	—	LD
June 21-22	LD	—	2.8
June 28-29	15	—	LD
July 5-7	LD	—	5.7
July 12-14	LD	—	LD
July 20-22	10	—	LD
July 26-27	LD	—	2.8
Longueuil treatment plant (2)			
May 19	55	1.0	11
June 28	20	—	20
September 7	LD	—	LD

(1): For the CUM plant, the mean concentrations were calculated from the results obtained with samples drawn over 2 or 3 consecutive days.

(2): For the Longueuil plant, the mean concentrations were calculated from the results obtained with 4 samples drawn in a single day during three rainfall events.

LD: Limit of detection does not allow for criterion verification.

—: No exceedance of the water quality criterion (i.e. exceedance < 1).

4.2.1.5 *Interpretation of exceedances of chronic water quality criteria for the protection of aquatic life*

Exceedances of CCAL were observed at all plants for 11 physico-chemical parameters, eight metals and four families of organic substances (SVOCs, VOCs, surfactants and pesticides). Exceedances were mostly infrequent and of low amplitude. However, a few substances regularly exhibited exceedances at several plants, both in winter and summer. In the case of ammonia nitrogen, phosphorus, hydrogen sulfide, aluminum, silver, chromium, copper and two insecticides (diazinon and chlorpyrifos), amplitudes were above 10. Such was also the case for surfactants, for which exceedances reached amplitudes of up to approximately 400 times the CCAL. Nitrites and cyanides also exhibited a periodic high amplitude exceedance (> 20).

The presence of these substances at such concentrations, added to the possible combined effects of many contaminants, suggests that the municipal wastewaters are potentially harmful in the long term to aquatic life in watercourses with a weak assimilative capacity.

4.2.2 Prevention of the contamination of aquatic organisms

Water quality criteria for the prevention of the contamination of aquatic organisms are defined to protect their consumption by humans and by piscivorous wildlife. The two following sections compare the results of the physico-chemical analyses to these quality criteria.

4.2.2.1 Human consumption of aquatic organisms

Water quality criteria for the prevention of the contamination of aquatic organisms (CPCOs) are defined to protect individuals who would, throughout their lifetimes, consume aquatic organisms exposed to such concentrations. In this way, aquatic organisms are protected from any contamination that would be hazardous to humans who consume them, now or in future. Consequently, the quality criteria for this use of the water are defined for substances that tend to accumulate in the food chain and that are known to have detrimental effects. The exceedance of a CPCO at the effluent does not mean that those who consume fish are currently at risk, but rather that the effluent contains substances that can potentially accumulate in aquatic organisms, and consequently, degrade the quality of the body tissues of organisms that are exposed to them.

There are CPCOs for toxic substances that can be potentially bioaccumulated in aquatic organisms. Tables 4.6-W and 4.6-S present the amplitudes of exceedances of all the substances analysed for which such a quality criterion exists.

PHYSICO-CHEMICAL PARAMETERS

For the physico-chemical parameter group (PCP), one CPCO is defined for cyanides. No exceedance was observed for this parameter.

METALS

In the case of metals, a CPCO exists for antimony (Sb), arsenic (As), mercury (Hg) and nickel (Ni). Exceedances were observed only for arsenic and mercury.

All seasons combined, three exceedances of the CPCO were recorded for mercury and there were exceedances for arsenic almost everywhere it was measured. These exceedances were generally of low amplitude, however. For mercury, the exceedances were observed at three plants with a large industrial loading. In the case of arsenic, the greatest exceedances were also recorded where industrial inputs are significant, except for the Martinville plant.

TABLE 4.6-W: AMPLITUDES OF EXCEEDANCE OF WATER QUALITY CRITERIA FOR THE PREVENTION OF THE CONTAMINATION OF AQUATIC ORGANISMS (CPCO) FOR ALL SUBSTANCES ANALYSED (WINTER)

Treatment plant (winter)	Characteristics			Exceedances of CPCO for all substances analysed												
				PCPs	Metals				SVOCs VOCs	PCBs	PAHs					Chlorinated dioxins and furans
	TT	II	Deph	CN⁻	Sb	As	Hg	Ni			Group 1	Anthracene	Fluoranthene	Fluorene	Pyrene	
Farnham	AS	high	wo	—			LD	—	—	46	—	—	—	—	—	
La Prairie	AS	high	wo	—			LD	—	—	42	—	—	—	—	—	—
Magog	AS	high	with	—			5.9	—								
CUO	AS	low	with	—			LD	—								
Jonquière	AS	low	wo	—			LD	—								
Châteauguay	BF	low	wo	—			LD	—								
CUQ (East plant)	BF	low	wo	—			LD	—	—	53	—	—	—	—	—	2.7
Cookshire	AL	high	wo	—			LD	—	—	197						
Saint-J.-de-Beauce	AL	high	wo	—			LD	—								
Warwick	AL	high	wo	—			LD	—								
Saint-Gédéon	AL	low	wo	—			LD	—								
Sawyerville	AL	low	wo	—			LD	—								
Martinville	UL	low	with	—	—	13	—	—	—	12	—	—	—	—	—	1.3
CUM	PC	high	with	—			LD	—	—							
Longueuil	PC	low	with	—			LD	—	—	40	—	—	—	—	—	2.7

Treatment type (TT):

AS:	activated sludge
BF:	biofiltration
AL:	aerated lagoons
UL:	unaerated lagoons
PC:	physico-chemical

II:	industrial inputs
Deph:	dephosphatization
wo:	without dephosphatization

LD:	limit of detection does not allow for criterion verification
—:	no exceedance of water quality criterion (i.e. exceedance < 1)
*:	result rejected
Blank box:	parameter not measured
( ):	questionable result (quality control); to be considered with caution

TABLE 4.6-S: AMPLITUDES OF EXCEEDANCE OF WATER QUALITY CRITERIA FOR THE PREVENTION OF THE CONTAMINATION OF AQUATIC ORGANISMS (CPCO) FOR ALL SUBSTANCES ANALYSED (SUMMER)

Treatment plant (summer)	Characteristics			Exceedances of CPCO for all substances analysed												
	TT	II	Deph	PCPs	Metals				SVOCs VOCs	PCBs	PAHs					Chlorinated dioxins and furans
				CN^-	Sb	As	Hg	Ni			Group I	Anthra-cene	Fluoran-thene	Fluorene	Pyrene	
Farnham	AS	high	with	—	—	3.6	2.0	—	—	24	—	—	—	—	—	11
La Prairie	AS	high	wo	—	—	4.3	—	—	—	14	—	—	—	—	—	1.0
Magog	AS	high	with													
CUO	AS	low	with	—	—	2.9	—	—	—	7.9	—	—	—	—	—	—
Jonquière	AS	low	wo	—	—	—	—	—	—	6.6	—	—	—	—	—	2.1
Châteauguay	BF	low	with	—	—	3.6	—	—	—	23	—	—	—	—	—	3.5
CUQ (East plant)	BF	low	wo	—	—	4.3	—	—	—	51	—	—	—	—	—	9.3
Cookshire	AL	high	wo	—	—	7.1	2.1	—	—	(1)	—	—	—	—	—	188
Saint-J.-de-Beauce	AL	high	with	—	—	1.4	—	—	—	8.1	—	—	—	—	—	5.8
Warwick	AL	high	with													
Saint-Gédéon	AL	low	wo	—	—	—	—	—	—	7.1	—	—	—	—	—	34
Sawyerville	AL	low	with	—	—		LD	—								
Martinville	UL	low	wo	—			LD	—								
CUM (1998)	PC	high	with	—	—	2.9	—	—	—	35	1.7	—	—	—	—	19
CUM (1999)	PC	high	with	—	—	6.4	—	—								
Longueuil (1998)	PC	low	with	—	—	5.0	—	—	—	50	—	—	—	—	—	23
Longueuil (1999)	PC	low	with	—	—	4.3	LD	—								

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
wo: without dephosphatization

LD: limit of detection does not allow for criterion verification
—: no exceedance of water quality criterion (i.e. exceedance < 1)
*: result rejected
Blank box: parameter not measured
( ): questionable result (quality control); to be considered with caution

(1): PCBs could not be measured at the Cookshire plant because samples contained too much organic matter.

It is not possible to assess the differences between the two characterization campaigns. On the one hand, arsenic was not analysed in 1996–97 and, on the other hand, the analysis method used during this campaign was not precise enough to measure mercury concentrations. For this reason, the results for mercury are always below the LD in 1996–97, except at the Magog plant, where, it should be noted, analyses were carried out in summer 2000 using a more sensitive analysis method than the one used in winter 1997. In the three samples analysed, mercury was never detected, which casts some doubt on the particularly high results obtained at the Magog plant in 1997.

SEMI-VOLATILE (SVOCS) AND VOLATILE (VOCS) ORGANIC SUBSTANCES

There are several CPCOs for these two families of substances, particularly for several chlorinated benzenes, phthalates and volatile organic substances. No exceedances of the CPCOs were observed for SVOCs or VOCs.

SURFACTANTS

No CPCO is defined for nonionic or anionic surfactants.

PCBS

Exceedances of the CPCO were recorded at every plant where PCB analyses were carried out, and they were of high amplitude in the majority of cases. By far the most significant exceedance was recorded at the Cookshire plant (197), which takes in a very large industrial loading. The other most significant exceedances were recorded at the Farnham (46 in winter), La Prairie (42 in winter) and CUM (35 in summer) plants, which all have substantial industrial loads, as well as at the CUQ (53 in winter and 51 in summer) and Longueuil (40 and 50) plants, where the industrial input is considered less significant. These plants, especially the one in Longueuil, still receive heavy loadings of industrial wastewater.

Industrial sources are not the only factors contributing to the concentrations found in effluents. As mentioned in Section 2.4.3.2, there are many sources of PCBs and these substances are already present in the environment because of their stability and persistent character. This observation is reflected in PCB concentrations measured in Quebec watercourses, which are often high relative to the water quality criteria (Quémerais *et al.*, 1994a and 1994b; Pham and Proulx, 1996; Cossa *et al.*, 1998), even exceeding them, in certain cases. Consequently, the concentrations of PCBs present in municipal wastewaters are in part due to the quality of the water supply and runoff water.

To measure the net input of PCBs by the treatment plants, it would be necessary to compare the concentrations with those of the receiving environment. The available information does not permit such an exercise for the vast majority of treatment plants in Quebec. This comparison can only be partially carried out at the CUM, La Prairie, Longueuil and CUQ plants. The Pham and Proulx study (1996) reported a mean concentration of 0.12 ng/L with a total of 13 congeners in the St. Lawrence River, upstream from the CUM effluent. In addition, the report on the mass balance of chemical contaminants in the St. Lawrence River (Cossa *et al.*, 1998) provides the means to obtain a mean concentration of 0.41 ng/L by summing 18 congeners common to the present study that are found in the St. Lawrence River just off Quebec City.

To compare these means, the total of the same 13 congeners in the Pham and Proulx study (1996) was calculated for the effluents of the CUM, La Prairie and Longueuil plants. Likewise, for the CUQ, the total of the 18 congeners in Cossa *et al.* (1998) was also calculated. Table 4.7 presents the exceedances of these concentrations compared with the mean ambient concentrations reported in the studies cited herein.

TABLE 4.7: COMPARISON BETWEEN MEAN CONCENTRATIONS OF PCBS MEASURED AT SOME TREATMENT PLANTS AND CONCENTRATIONS ALREADY PRESENT IN THE RECEIVING ENVIRONMENT

Treatment plant	**Mean concentration measured in effluent (ng/L)**		**Concentration in receiving waters [(1)] (ng/L)**	**Ratio of concentration in effluent:concentration in receiving waters**	
	Winter	**Summer**		**Winter**	**Summer**
Sum of 13 congeners					
CUM		1.78	0.12		15
La Prairie	1.52	0.39	0.12	13	3.3
Longueuil	2.34	3.33	0.12	20	28
Sum of 18 congeners					
CUQ (East plant)	3.96	3.73	0.41	10	9

(1) The value 0.12 ng/L represents the mean concentration in the environment measured upstream from the CUM effluent for 13 congeners (Pham and Proulx, 1996), and the value 0.41 ng/L was obtained at Quebec City by adding together the 18 congeners common to the present study (Cossa *et al.*, 1998).

These results show exceedances compared with concentrations found in the aquatic environment, but they are less significant than the exceedances of the quality criteria. Although the municipal treatment plants are not the only source, these results suggest nevertheless that there is a net discharge of PCBs into the receiving environment from these plants.

PAHs

A CPCO is defined for the total of the 16 Group 1 PAHs showing sufficient evidence of carcinogenicity (see Appendix 12). In the case of Group 2 PAHs, a CPCO was defined for anthracene, fluoranthene, fluorene and pyrene.

All plants and seasons combined, there were no exceedances of the CPCOs except for one very small exceedance (1.7) at the CUM plant in summer and only for Group 1 PAHs.

Although PAHs do not exceed quality criteria, except for one, the highest concentrations of PAHs were found in highly urbanized environments, with combined sewer systems. Atmospheric deposition and urban runoff may be accountable in part.

CHLORINATED DIOXINS AND FURANS

Chlorinated dioxins and furans were detected at all plants where they were analysed. With the exception of the CUO and La Prairie plants, the concentrations measured, expressed in toxic equivalents, exceed the CPCO by factors ranging from 1.3 to 188.

Just as for PCBs, Cookshire presents by far the most significant exceedance (188). As mentioned in Section 2.4.3.2, many industrial processes, including the production of colorants and pigments, can generate dioxins and furans. It is therefore plausible that industries that use colorants in large quantities, such as the textile mill in Cookshire, could discharge a substantial quantity of these substances in their wastewater.

The other largest exceedances were observed at plants having both large and small industrial inputs; that is, the CUM (19), Farnham (11), Longueuil (23) and Saint-Gédéon (34) plants. These results can be explained in part by the fact that the biggest sources of dioxins and furans seem related to waste incineration and wood combustion. Atmospheric deposition and urban runoff could therefore carry substantial quantities of dioxins and furans to the municipal treatment plants.

In fact, significant concentrations of chlorinated dioxins and furans were measured in a few watercourses in Quebec. As far as is actually known, concentrations of dioxins and furans in watercourses in urban areas are often close to or higher than their water quality criterion. For example, the median value (in toxic equivalent) estimated in the St. Lawrence River near Quebec City is 0.012 pg/L, a concentration close to the CPCO, which is 0.014 pg/L.

4.2.2.2 Consumption of aquatic organisms by piscivorous wildlife

Water quality criteria for the protection of piscivorous wildlife (CPPW) refer to the concentration of a substance in the water that will not cause multi-generational deleterious effects on the survival of the birds or mammals exposed thereto by their consumption of contaminated aquatic organisms. These criteria are defined to protect even the biggest fish-eaters, such as minks, otters and kingfishers. Exceedance of a CPPW at the effluent means that it contains highly bioaccumulable toxic substances that could be harmful to wildlife that feed on organisms to which they are exposed.

There are at present three substances or families of substances for which a CPPW has been defined: mercury, PCBs and chlorinated dioxins and furans. Table 4.8 presents the amplitudes of exceedances of the CPPW for these three parameters. Wherever they were analysed and detected, these parameters exceed the CPPWs, and the exceedances are of very high amplitude in the majority of cases.

TABLE 4.8: AMPLITUDES OF EXCEEDANCE OF WATER QUALITY CRITERIA FOR THE PROTECTION OF PISCIVOROUS WILDLIFE (CPPW) FOR ALL SUBSTANCES ANALYSED (WINTER AND SUMMER)

Treatment plant	Characteristics			Exceedances of CPPW for all substances analysed					
				Winter			Summer		
	TT	II	Deph W/S	Hg	PCBs	Chlorinated dioxins and furans	Hg	PCBs	Chlorinated dioxins and furans
Farnham	AS	high	wo/w	LD	65		77	34	47
La Prairie	AS	high	wo/wo	LD	59	4.0	12	20	4.4
Magog	AS	high	w/w	231					
CUO	AS	low	w/w	LD			25	11	3.5
Jonquière	AS	low	wo/wo	LD			6.2	9.4	9.5
Châteauguay	BF	low	wo/w	LD			30	32	16
CUQ (East plant)	BF	low	wo/wo	LD	75	12	38	73	42
Cookshire	AL	high	wo/wo	LD	280		85	(1)	847
Saint-Joseph-de-Beauce	AL	high	wo/w	LD			17	12	26
Warwick	AL	high	wo/w	LD					
Saint-Gédéon	AL	low	wo/wo	LD			8.5	10	151
Sawyerville	AL	low	wo/w	LD			LD		
Martinville	UL	low	w/wo	20	18	5.8	LD		
CUM (S-98)	PC	high	w/w	LD			10	50	87
CUM (S-99)	PC	high	w/w				13		
Longueuil (S-98)	PC	low	w/w	LD	57	12	15	71	103
Longueuil (S-99)	PC	low	w/w				LD		

Treatment type (TT):
AS: activated sludge
BF: biofiltration
AL: aerated lagoons
UL: unaerated lagoons
PC: physico-chemical

II: industrial inputs
Deph: dephosphatization
w: with dephosphatization
wo: without dephosphatization
W: winter
S: summer

LD: limit of detection does not allow for criterion verification
—: no exceedance of water quality criterion (i.e. exceedance < 1)
*: result rejected
Blank box: parameter not measured
( ): questionable result (quality control): to be considered with caution

(1): PCBs could not be measured at the Cookshire plant because samples contained too much organic matter.

Exceedances of the CPPW were higher than exceedances of the CPCO, since fish-eating terrestrial wildlife are more likely to be affected by the contamination of aquatic organisms. For one thing, animals eat much more fish than do humans. Further, since they eat the entire organism, raw, they are more exposed to contamination because concentrations are higher in viscera and fat than in flesh alone. The protection limits for these consumers are consequently lower.

The case of mercury (Hg) is similar to that of PCBs and dioxins and furans, as discussed earlier. Mercury is bioaccumulable and persistent in the environment; high concentrations, which are significant relative to water quality criteria, were measured in a few watercourses in urban areas of Quebec. Concentrations of Hg measured in municipal wastewaters therefore have multiple sources, including the water supply, urban runoff, and industrial inputs.

Since both the CPPWs and CPCOs are defined for similar uses, the discussion concerning exceedances of the CPCOs for mercury, PCBs and chlorinated dioxins and furans also applies here (see Section 4.2.2.1 above).

4.2.2.3 Interpretation of exceedances of water quality criteria for the protection of aquatic organisms

An analysis of the amplitudes of exceedances of water quality criteria for the protection of aquatic organisms (CPCO and CPPW) shows that certain highly bioaccumulable toxic substances are a significant presence in municipal effluents. Measured concentrations of PCBs and chlorinated dioxins and furans may limit human consumption of the aquatic organisms exposed to these substances, because of their propensity to accumulate in the food chain. Mercury is also of concern for piscivorous terrestrial wildlife, for whom the toxic potential of these three parameters can be even more detrimental, for reasons explained in the preceding section.

The sources of these substances in municipal wastewaters are multiple and complex. They may originate, among other sources, in the water supply, from atmospheric deposition, urban runoff, and the industrial load received at the plant. In order to determine the actual contribution of municipal treatment plants, we need to know more about the potential sources as well as the concentrations already present in the receiving environments of the treatment plants.

4.3 Relationship between the Toxicity Measured and Exceedances of Water Quality Criteria

This section attempts to identify the possible relationships between the results of the toxicity tests and the exceedances of quality criteria, in order to identify which substances could be the cause of the toxicity measured. However, the identification of such a link is not an indication of causality since, on the one hand, quality criteria take into account a wider range of effects and aquatic species and, on the other hand, toxic responses may be attributed to other chemical substances not included in the analyses or even to interaction among contaminants. The purpose of this section, then, is to identify those contaminants that might be associated with toxic effects for organisms exposed thereto. No statistical analysis was performed because of the small number of samples.

For the purposes of this comparative analysis, quality criteria corresponding to the same effect threshold measured with the toxicity tests are used. Consequently, for the results of the chronic toxicity tests, chronic water quality criteria for the protection of aquatic life (CCAL) are used. In the case of acute lethality, for which the results are determined based on the LC_{50}, the final acute value (FAV) is retained. The latter corresponds to the concentration that could kill 50% of the sensitive organisms exposed to it (MEF, 1998)[7].

The results of this comparative exercise are given in the two following sections. BOD_5, SM and total phosphorus were excluded from the analysis since these parameters are not direct causes of toxicity in the test species.

4.3.1 Acute toxicity

Tables 4.9-W and 4.9-S present the *daily concentration measured:final acute value (FAV)* ratios relative to the daily results of the acute toxicity tests (i.e. result from samples of day 1 - day 3 - day 5). Only those samples with a ratio ≥ 1 are shown in the tables.

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[7] The final acute value (FAV) corresponds to twice the acute water quality criterion for the protection of aquatic life (ACAL) (MEF, 1998). ACAL represents the concentration of a contaminant at which aquatic organisms can be exposed for a short period of time without dying.

TABLE 4.9-W: RELATIONSHIP BETWEEN ACUTE TOXICITY TEST RESULTS AND EXCEEDANCES OF THE FINAL ACUTE VALUES (FAV) FOR ALL SUBSTANCES ANALYSED (WINTER)

Treatment plant (winter)	Acute toxicity test results (acute toxic units: TUa) (day 1 – day 3 – day 5)		Exceedances of the final acute value (daily concentration / FAV ≥1) (day 1 – day 3 – day 5)					
	D. magna	*O. mykiss*	Physico-chemical parameters			Metals		Nonionic surfactants
			$NH_3 - NH_4^{+}$ (1)	NO_2^-	CN^-	Al	Cu	
Farnham	nl - nl - nl	nl - nl - nl	—	—	—	—	Ø - Ø - 1.0	Ø - 1.7 - 2.1
La Prairie	nl - nl - nl	nl - nl - nl	—	—	—	—	—	
Magog	nl - nl - nl	nl - nl - nl	—	—	—	—	—	
CUO	nl - nl - nl	nl - nl - nl	—	—	—	1.1 - 2.8 - 1.5	Ø - 1.6 - 1.4	
Jonquière	nl - nl - nl	nl - * - nl	—		—	—	—	
Châteauguay	nl - nl - nl	* - nl - nl	—	—	—	—	—	
CUQ (East plant)	nl - nl - nl	nl - <1 - nl	1.1 - 1.2 - 1.2		—	—	—	
Cookshire	3.2 - 1.6 - 2	>1 - * - >1	1.0 - 1.1 - 1.1		—	—	—	3.9 - 4.3 - 4.7
Saint-J.-de-Beauce	nl - nl - nl	>1 - >1 - >1	2.4 - 2.5 - 2.6		—	—	—	
Warwick	nl - nl - nl	>1 - >1 - *	1.3 - 1.2 - 1.4		—	—	—	—
Saint-Gédéon	nl - nl - nl	>1 - >1 - >1	Ø - 1.0 - 1.0		—	—	—	
Sawyerville	nl - nl - <1	<1 - <1 - *	1.0 - 1.0 - 1.1		—	—	—	
Martinville	nl - nl - nl	* - * - *	—	—	—	—	—	—
CUM	nl - nl - nl	nl - nl - ns	—	—	—	—	—	1.2 - Ø - Ø
Longueuil	nl - nl - nl	ns - nl - ns	Ø - 1.1 - 1.1		—	—	—	

<1: less than 50% of mortality
>1: more than 50% of mortality in the undiluted effluent
nl: non-lethal (0% of mortality)
ns: non-significant
*: result rejected
—: no exceedance of the FAV for the three daily samples (day 1, day 3 and day 5)
Ø: no exceedance of the FAV for this daily sample (i.e. exceedance < 1)
Blank box: parameter not measured

(1): The FAV value used for ammonia nitrogen is the threshold toxicity concentration of 10 mg/L of Beak and Canviro (1990).

TABLE 4.9-S: RELATIONSHIP BETWEEN ACUTE TOXICITY TEST RESULTS AND EXCEEDANCES OF THE FINAL ACUTE VALUES (FAV) FOR ALL SUBSTANCES ANALYSED (SUMMER)

Treatment plant (summer)	**Acute toxicity test results (acute toxic units: TUa) (day 1 – day 3 – day 5)**		**Exceedances of the final acute value (daily concentration / FAV ≥1) (day 1 – day 3 – day 5)**					
			Physico-chemical parameters			**Metals**		**Nonionic surfactants**
	D. magna	***O. mykiss***	**$NH_3 – NH_4^+$ (1)**	**NO_2^-**	**CN^-**	**Al**	**Cu**	
Farnham	nl - nl - nl	nl - nl - nl	—	—	—	—	—	—
La Prairie	nl - nl - nl	1.4 - 1.7 - 1.9	2.6 - 2.2 - 2.5	—	—	—	—	—
CUO	nl - nl - nl	nl - nl - nl	—	—	—	—	—	—
Jonquière	nl - nl - <1	nl - nl - <1	—	—	—	—	—	—
Châteauguay	<1 - nl - nl	<1 - 1.5 - <1	—	—	—	—	—	—
CUQ (East plant)	nl - nl - nl	nl - nl - nl	—	—	—	—	—	—
Cookshire	<1 - 2.9 - 1.4	nl - nl - nl	—	Ø - Ø - 1.0	—	—	—	—
Saint-J.-de-Beauce	1.4 - 1.4 - <1	nl - nl - nl	—	21 - 19 - 9.2	3.1 - 2.5 - 3.4	—	—	—
Saint-Gédéon	nl - nl - <1	nl - nl - <1	—	—	Ø - 1.1 - 1.1	—	—	—
Sawyerville	<1 - nl - nl	* - nl - nl	—		—	—	—	* - * - *
Martinville	nl-nl-nl-nl	*-nl-nl-nl	—	—	—	—	—	
CUM (1998)	nl - nl - nl	nl - <1 - nl	—	—	—	—	—	Ø - Ø - 1.1
CUM (1999)	nl - nl - nl	nl - nl - ns	—	—	—	—	—	3.5 - 1.4 - Ø
Longueuil (1998)	3 - 1.4 - 1.3	2.8 – 2.8 – 1.4	—	—	—	2.4 - 1.3 - 1.5	—	5.3 - 4.3 - 3.1
Longueuil (1999)	nl - nl - nl	1.3 - <1 - <1	Ø - 1.1 – 1.0	—	—	—	—	1.2 - 3.5 - 1.7

<1:	less than 50% of mortality
>1:	more than 50% of mortality in the undiluted effluent
nl:	non-lethal (0% of mortality)
ns:	non-significant
*:	result rejected
—:	no exceedance of the FAV for the three daily samples (day 1, day 3 and day 5)
Ø:	no exceedance of the FAV for this daily sample (i.e. exceedance < 1)
Blank box:	parameter not measured

(1): The FAV value used for ammonia nitrogen is the threshold toxicity concentration of 10 mg/L of Beak and Canviro (1990).

In the case of ammonia nitrogen, the exceedances were first calculated using the FAV provided by the MENV (1998), which is determined according to the pH measured before each toxicity test and the temperature maintained during the tests. Exceedances were observed only at the La Prairie plant in summer and they coincided with toxic effects in *O. mykiss*. The exceedances were later calculated using the values 0.1 mg/L of non-ionized NH_3 and 10 mg/L of ammonia nitrogen (NH_3-NH_4^+). These values were taken from Ontario studies (Beak and Canviro, 1990; Orr *et al*., 1992), which established that municipal effluents are generally toxic to rainbow trout (toxicity test with *O. mykiss*) when one of the values is exceeded. Finally, the exceedances retained and presented in tables 4.9-W and 4.9-S were calculated using the value 10 mg/L of ammonia nitrogen.

An analysis of the data in tables 4.9-W and 4.9-S shows that there is no clear relationship between FAV exceedances and the acute toxicity measured by the toxicity tests in the effluents, except for ammonia nitrogen and, to a lesser degree, nitrites and nonionic surfactants. For example, at the CUO plant, in winter, exceedances in more than one substance were observed without any toxicity being measured, while at Châteauguay, in summer, where one toxicity measurement was recorded, no exceedance was detected.

For several plants, exceedances of ammonia nitrogen (NH_3-NH_4^+) coincide with the observation of toxic effects in the toxicity tests. Of the 24 results with an equivalent value or that exceed the FAV value of 10 mg/L, 17 correspond to the observation of toxic effects in *O. mykiss*, which are associated, for the most part, with aerated lagoon effluents in winter. Four other exceedances correspond to toxicity tests for which the results were rejected or non-significant, and, finally, three do not correspond to lethal effects (Longueuil on day 3 in winter and CUQ on days 1 and 5 in winter). The results of the present study, as in others (Beak and Canviro, 1990; Orr *et al*., 1992), suggest the existence of a relationship between the toxicity measured in *O. mykiss* and the exceedance of the value of 10 mg/L of ammonia nitrogen at the effluent.

The most substantial exceedances of the FAV were obtained in nitrites at the Saint-Joseph-de-Beauce plant in summer. Exceedance values of 21 and 19 were recorded with day 1 and day 3 samples, which match the toxic responses of 1.4 TUa in *D. magna* for these two sampling days. These high concentrations of nitrites could, therefore, partly explain the toxicity measured in *D. magna* at this treatment plant.

There is no FAV for anionic surfactants, but the value of 0.94 mg/L was defined for nonionic surfactants. Consequently, the concentration:FAV ratio could only be calculated for the latter. Among plants where analyses for surfactants were performed, the Cookshire plant in winter and the Longueuil plant in summer presented the greatest exceedances of the FAV (exceedances > 3.5), which coincide with high values of acute toxicity in daphnia (*D. magna*). These results are interesting in that daphnia could be particularly sensitive to surfactants, which might attack their shells.

As mentioned earlier, it is interesting to note that certain plants have significant exceedances of the FAVs without any toxicity being detected by the toxicity tests. These results might be explained by the fact that the contaminants are not bioavailable in the effluent or that the species used in the toxicity tests are less sensitive than those that were used to define quality criteria. Conversely, toxicity was detected in certain samples without any observed exceedance of the FAV. In this case, the results can be explained, at least in part, by the combined effect of several substances or by substances being present but not analysed in the effluent.

In summary, ammonia nitrogen appears to be the main contaminant responsible for the acute toxicity measured in *O. mykiss*, while nitrites and surfactants could contribute to the acute toxicity measured in *D. magna*.

4.3.2 Chronic toxicity

Tables 4.10-W and 4.10-S present the *mean measured concentration:CCAL* ratio for each contaminant having exceeded the quality criteria, in relation to the chronic toxicity test results. Only exceedances of CCAL > 2 appear in the tables to highlight the parameters most significantly related to the measured toxicity.

All seasons combined, there are positive chronic toxicity responses at all plants, with the exception of the Martinville plant. There were also exceedances of CCALs at all plants, a majority of which presented exceedances for several substances simultaneously. A relationship could therefore be established between the simultaneous presence of several contaminants at concentrations greater than the safe limits and the toxicity measured in *P. promelas* and *C. dubia*.

As with the acute toxicity results presented in the previous section, it is not possible to establish a precise relationship between exceedances of CCAL for one or more substances and the chronic toxicity measured. However, the presence of ammonia nitrogen, chromium, copper and anionic surfactants at concentrations greater than safe limits often corresponds with acutely toxic responses. For example, in *C. dubia*, 80% of the toxic responses ≥ 4 TUc coincide with simultaneous exceedances (> 2) of these four parameters.

In addition, substantial exceedances for several substances coincide with elevated toxic responses. Such is the case for nitrites (exceedance of 100) and cyanides (26), which could partly explain the chronic toxicity measured at Saint-Joseph-de-Beauce in summer. Aluminum, with CCAL exceedances of 31 and 30, could also explain part of the toxicity at the CUO and Longueuil plants, respectively. For the same reasons, hydrogen sulfide, silver and nonionic surfactants can be added to the list.

TABLE 4.10-W: RELATIONSHIP BETWEEN CHRONIC TOXICITY TEST RESULTS AND EXCEEDANCES (≥ 2) OF THE CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC (CCAL) LIFE FOR ALL SUBSTANCES ANALYSED (WINTER)

Treatment plant (winter)	Chronic toxicity test results (TUc)		Exceedances of the chronic water quality criteria for the protection of aquatic life (mean concentration / CCAL ≥ 2)														
			Physico-chemical parameters						Metals					VOCs	Surfactants	
	P. promelas	*C. dubia*	NH_3-NH_4^+ (1)	NO_2^- (2)	H_2S (3)	CN^-	F	Phenolic subst.	Al	Ag	Cr	Cu (4)	Fe	Toluene	Nonionic	Anionic
Farnham	4	2	—	—		LD	2.3	—	9.0	LD	(8.0)	12	4.2	*	67	14
La Prairie	5.9	1	4.5	—		LD	—	—	—	LD	14	—	—	—		
Magog	2	1	—	—		LD	—	—	4.0	LD	(7.5)	(6.5)	3.9			
CUO	8	1	7.2	—		LD	—		31	20	(6.0)	18	11			
Jonquière	2	1	2.7			LD	—		2.3	LD	—	4.0	—			
Châteauguay	2	1	9.7	—		LD	3.7		—	LD	(8.5)	8.7	4.3			
CUQ (East plant)	> 17	2	14			LD	4.0	—	3.4	80	2.5	6.7	2.9	15		
Cookshire	8	16	12			LD	—	—	2.3	50	6.0	14	—	—	190	53
Saint-J.-de-Beauce	17	2	29			LD	—		—	50	—	3.5	4.1			
Warwick	7.7	2	15			LD	—		2.3	40	—	2.1	—		38	4.5
Saint-Gédéon	2	1	12			LD	—		—	30	—	5.3	—			
Sawyerville	2	1	12			LD	—		—	20	—	12	—		*	LD
Martinville	1	1	4.3	—	20	—	—	—	2.9	—	—	—	—	2.8	LD	4.3
CUM	(> 100)	4	7.7	—		LD	—	—	—	LD	13	5.6	5.8	5.4	48	53
Longueuil	11	2	11			LD	—	—	11	LD	13	2.9	—	—		

TUc:	chronic toxicity unit
LD:	limit of detection does not allow for criterion verification
—:	no exceedance of the water quality criterion or exceedance lower than 2 (i.e. exceedance < 2)
*:	result rejected
Blank box:	parameter not measured
( ):	questionable result (quality control): to be considered with caution

(1): CCAL for NH_3-NH_4^+ is determined at each treatment plant from the mean temperature and pH values measured during the chronic toxicity tests.

(2): CCAL for NO_2^- is determined at each treatment plant from the mean chloride concentration measured in the effluent.

(3): Non-ionized H_2S concentration is calculated from the mean concentration of dissolved sulfides measured in the effluent.

(4): CCAL for copper is calculated from the mean hardness measured at each plant.

TABLE 4.10-S: RELATIONSHIP BETWEEN CHRONIC TOXICITY TEST RESULTS AND EXCEEDANCES (≥ 2) OF THE CHRONIC WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC (CCAL) LIFE FOR ALL SUBSTANCES ANALYSED (SUMMER)

Treatment plant (summer)	Chronic toxicity test results (TUc)		Exceedances of the chronic water quality criteria for the protection of aquatic life (mean concentration / CCAL ≥ 2)													
			Physico-chemical parameters						Metals					VOCs	Surfactants	
	P. promelas	*C. dubia*	NH_3-NH_4^+ (1)	NO_2^- (2)	H_2S (3)	CN^-	F^-	Phenolic subst.	Al	Ag	Cr	Cu (4)	Fe	Toluene	Nonionic	Anionic
Farnham	1	1	—	—	LD	—	3.1	—	7.9	—	—	4.1	—	—	LD	13
La Prairie	4	4	28	—	LD	—	—	—	—	—	—	—	—	—	LD	5.9
CUO	4	1	5.7	—	LD	—	—	—	—	—	—	2.2	—	—	LD	2.9
Jonquière	16	16	(2.2)	—	LD	LD	(—)	—	—	—	4.0	3.6	—	—	LD	3.2
Châteauguay	2	2	11	—	2.1	—	4.6	—	6.7	4.0	—	3.1	—	—	11	23
CUQ (East plant)	4	1	11	—	LD	—	3.8	—	—	22	—	5.7	2.6	—	13	33
Cookshire	17	4	7.9	3.0	LD	—	—	2.0	—	—	10	9.9	—	•	LD	11
Saint-J.-de-Beauce	1	16	(—)	100		26	(—)	—	—	—	2.0	2.9	—	—	LD	7.0
Saint-Gédéon	4	16	(9.5)	2.9		10	(—)	—	—	—	2.5	4.7	—	—	LD	11
Sawyerville	1	2	2.1			4.0	—		—	(LD)	7.1	—	—			
Martinville	1	1	LD			LD	—		—	LD	11	—	—			
CUM (1998)		4	5.7	—	4.3	4.0	(—)	—	11	11	4.0	7.0	—	•	44	57
CUM (1999)	33	4	7.1	—	30	4.0	—	—	8.8	7.0	2.7	5.6	—		81	44
Longueuil (1998)		16	11	(—)	26	LD	(—)	2.0	30	7.0	13	3.6	—	•	189	383
Longueuil (1999)	2	2	12	—	39	—	—	2.0	11	—	2.4	—	—		95	79

TUc: chronic toxicity unit
LD: limit of detection does not allow for criterion verification
—: no exceedance of the water quality criterion or exceedance lower than 2 (i.e. exceedance < 2)
•: result rejected
Blank box: parameter not measured
( ): questionable result (quality control); to be considered with caution

(1): CCAL for NH_3-NH_4^+ is determined at each treatment plant from the mean temperature and pH values measured during the chronic toxicity tests.
(2): CCAL for NO_2^- is determined at each treatment plant from the mean chloride concentration measured in the effluent.
(3): Non-ionised H_2S concentration is calculated from the mean concentration of dissolved sulfides measured in the effluent.
(4): CCAL for copper is calculated from the mean hardness measured at each plant.

Finally, certain pesticides are also targeted because they were confirmed at concentrations greater than that of the CCALs at the CUM and Longueuil plants (Section 4.2.1.4). Although their presence may explain, in part, the measured toxicity, no parallel can be drawn in this case, since pesticides were analysed in different samples.

In summary, of the substances analysed, those suspected of significantly contributing to the chronic toxicity in *P. promelas* and *C. dubia* are ammonia nitrogen, surfactants and certain metals. Further, the simultaneous presence of several substances can also partly explain the toxicity measured.

4.3.3 Substances responsible for the toxicity measured

The analysis presented in the two previous sections shows that ammonia nitrogen is probably mainly responsible for the acute and chronic toxicity measured. Surfactants may be the second most widespread contaminant, while certain metals (mainly copper, chromium and aluminum) are suspected of chronic effects. In certain specific cases, nitrites, cyanides and hydrogen sulfide could also have played a role. Finally, the presence of pesticides in summer — diazinon and, more particularly, chlorpyrifos — could be an additional source of toxicity.

Only studies focused on toxicity identification, as described in the guide for evaluating and reducing toxic substances (*Guide d'évaluation et de réduction des toxiques*) (MENV, 1996c), would allow us to verify this, however, and to determine, on an individual basis, which substances are actually responsible for the acute and chronic toxicity.

It should be noted that such studies were conducted in the United States and elsewhere in Canada and that they corroborate several of the observations of the present study. Using acute toxicity tests and the occasional chemical analysis, these studies identified substances at the origin of the toxicity in certain municipal effluents. Ammonia nitrogen, chlorine, certain metals, surfactants and pesticides were identified again and again. The studies also demonstrated the variability of these effluents, given the many different sources of contaminants of which they are constituted (domestic wastewater, runoff water, and industrial wastewater). Indeed, the toxicity of a given effluent could sometimes be attributed to the presence of ammonia nitrogen, whereas it might later be linked to the presence of pesticides or metals (Burgess *et al.*, 1995).

Ammonia nitrogen is probably the most commonly identified toxic compound in the municipal effluents surveyed in these studies (Burgess *et al.*, 1995; Environment Canada, 1997; Fisher *et al.*, 1998; Bailey *et al.*, 1999).

Chlorine, when present, is almost always the primary cause of toxicity (Orr *et al.*, 1992; Burgess *et al.*, 1995; Asami *et al.*, 1996). The absence of chlorination in Quebec wastewater treatment processes may explain the generally good results obtained in terms of acute and chronic toxicity.

The metals most commonly identified in some studies are copper, lead and zinc (Burgess *et al.*, 1995; Environment Canada, 1997).

The organic compounds, particularly surfactants, that are sometimes identified as a cause for toxicity are often linked to the textile industry. Studies using more specific analytic techniques have identified nonyl-octyl phenol ethoxylates and carboxylates, among other substances. They are among the most targeted contaminants because of their disruptive effects on the endocrine system of organisms exposed thereto. They are generally detected in municipal effluents and in textile mill effluents. Their presence was confirmed in the water and sediments downstream of these effluents (Purdom *et al.*, 1994; Jobling *et al.*, 1998; Servos, 1998; Sekela *et al.*, 1999).

Finally, certain pesticides were also occasionally identified. In two studies, diazinon (Burkhard and Jenson, 1993), and diazinon and chlorfenvinphos (Bailey *et al.*, 1999) were identified as agents responsible for toxicity. In addition, diazinon and chlorpyrifos are also known to be present in treated and untreated water (overflow water) and for the additivity of their toxicity (Jones-Lee and Lee, 1999).

4.4 Effects of Treatment Plant Operation and Design Conditions on Toxicity

This section presents an evaluation of the following parameters affecting measured toxicity, based on data obtained during our study:

- wastewater treatment process type;
- season;
- significance of industrial BOD_5 load
- chemical dephosphatization.

Since the effects of treatment process type and season of the year are closely linked, they are jointly analysed in the same section.

4.4.1 Effects of treatment process type and season

Table 4.11 presents the maximum acute toxicity measured in *D. magna* and *O. mykiss* in relation to treatment process type and season of the year. An analysis of the results indicates that aerated lagoons are the treatment type in which maximum acute toxicity is most frequently greater than 1 TUa (six of nine results) and in which recurrence occurs more frequently in winter (four of five results) than in summer (two of four results).

TABLE 4.11: MAXIMUM ACUTE TOXICITY MEASURED BY TREATMENT TYPE AND SEASON

Type of treatment process	**Treatment plant**	**Maximum TUa (1) by season**		**Number of results above 1 TUa**
		Winter	**Summer**	
Activated sludge	Farnham	nl	nl	**1/9 (11%)**
	La Prairie	nl	1.9	
	Magog	nl		
	CUO	nl	nl	
	Jonquière	nl	< 1	
Biofiltration	Châteauguay	nl	1.5	**1/4 (25%)**
	CUQ (East plant)	< 1	nl	
Aerated lagoon	Cookshire	3.2	2.9	**6/9 (67%)**
	Saint-Joseph-de-Beauce	> 1	1.4	
	Warwick	> 1		
	Saint-Gédéon	> 1	< 1	
	Sawyerville	< 1	< 1	
Unaerated lagoon	Martinville	nl (2)	nl	**0/2 (0%)**
Physico-chemical	CUM	nl	< 1	**1/4 (25%)**
	Longueuil	nl	3	
Number of results above 1 TUa		**4/15 (25%)**	**5/13 (38%)**	**9/28 (32%)**

(1): Highest result obtained of the three daily samples and the two acute toxicity tests performed.
(2): Non-lethal for *D. magna* and non-valid results for *O. mykiss*.
nl: Non-lethal.

For samples drawn under winter operating conditions, the only acute toxicity results above 1 TUa were observed at plants with aerated lagoons (13 results out of 27 above 1 TUa) (see Table 3.2-W). Rainbow trout (*O. mykiss*) was particularly sensitive to the effluent samples from aerated lagoons in winter since 10 of the 13 results exceeding 1 TUa were observed with this species.

Under summer conditions, aerated lagoon effluents were found to be less toxic than in winter, the number of responses exceeding 1 TUa being four results out of 23 (Table 3.2-S). In this case, there were no results higher than 1 TUa in *O. mykiss* since the four results were observed in the daphnia *D. magna*. However, an opposite phenomenon is observed at plants carrying out activated sludge, biofiltration and physico-chemical treatments, because certain results exceeding 1 TUa were obtained in summer (3 results out of 24, 1 result out of 12 and 7 results out of 24, respectively) compared to none in winter.

The greatest number of results exceeding 1 TUa in summer were obtained at plants performing physico-chemical treatment. However, six of the seven results greater than 1 TUa come from samples drawn at the Longueuil plant in the summer of 1998 (Table 3.2-S). A document reports that several studies reveal results above 1 TUa for such primary treatment effluents with acute toxicity tests using fish and daphnia (UMA, 1993).

No result above 1 TUa was recorded for the plant with unaerated lagoons during both the winter and summer sampling campaigns. It should be noted, however, that the toxicity tests with trout carried out on the effluent from the spring lagoon emptying (winter conditions) proved to be invalid.

As for the acute toxicity results, Table 4.12 presents the maximum chronic toxicity measured in *S. capricornutum*, *P. promelas* or *C. dubia* relative to treatment type and season of the year. The results reveal that all treatment process types, except for the unaerated lagoons, showed chronic toxicity to one of the species. An examination of these results found no apparent significant relationship between the chronic toxicity of the effluents and the various processes, except, perhaps, for plants using physico-chemical treatment. The results obtained at the two plants that employ such a treatment process all exceed 2 TUc (4 results out of 4), which are the highest, with values always greater than 10 TUc. No significant seasonal trend was established.

TABLE 4.12: MAXIMUM CHRONIC TOXICITY MEASURED BY TREATMENT TYPE AND SEASON

Type of treatment process	**Treatment plant**	**Maximum TUc [1] by season**		**Number of results above 2 TUc**
		Winter	**Summer**	
Activated sludge	Farnham	4	1	**6/9 (67%)**
	La Prairie	5.9	4	
	Magog	2		
	CUO	8	4	
	Jonquière	2	16	
Biofiltration	Châteauguay	2	2	**2/4 (50%)**
	CUQ (East plant)	> 17	4	
Aerated lagoon	Cookshire	16	17	**7/9 (78%)**
	Saint-Joseph-de-Beauce	17	16	
	Warwick	7.7		
	Saint-Gédéon	2	16	
	Sawyerville	2.2	2	
Unaerated lagoon	Martinville	1	1	**0/2 (0%)**
Physico-chemical	CUM	(> 100)	33	**4/4 (100%)**
	Longueuil	11	16	
Mean TUc:	**- with the CUM**	**13.2**	**10.2**	-
	- without the CUM	**7.0**	**8.3**	
Number of results above 2 TUc		**10/15 (67%)**	**9/13 (69%)**	**19/28 (68%)**

(1): Highest result obtained of the three chronic toxicity tests performed.

The relationship between toxicity, treatment type, and season of the year was also assessed using the toxic print of the PEEP Index. These results, presented in Table 4.13, show that the effluents from aerated and unaerated lagoons were almost 10 to 20 times more toxic, respectively, (mean toxic prints 41.9 and 72.4 ATU.bvu^{-1}) than those of plants performing physico-chemical, biofiltration or activated sludge treatments. In addition, a significant difference is noted with regard to the seasonal effect on effluents of aerated and unaerated lagoons. The mean toxic print for aerated lagoons in winter is more than twice what it is in summer, while the mean measured at unaerated plants was relatively high in winter (72.4), but nil in summer.

TABLE 4.13: INFLUENCE OF TREATMENT TYPE AND SEASON ON THE PEEP INDEX TOXIC PRINT

Treatment type	**Number of treatment plants**		**Mean toxic print ($ATU.bvu^{-1}$)**		**Min - Max ($ATU.bvu^{-1}$)**	
	Winter	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**
Activated sludge	5	4	3.4	3.0	0.0–15.8	0.3–6.8
Biofiltration	2	2	3.4	1.3	0.0–6.8	0.0–2.6
Aerated lagoon	5	4	41.9	18.3	0.0–91.2	0.3–54.3
Unaerated lagoon	1	1	72.4	0.0	72.4	0.0
Physico-chemical	2	2	4.6	3.2	1.4–7.8	3.1–3.4

Overall, the results of the toxicity tests suggest that aerated lagoons are more likely to contain contaminants in sufficient concentrations to cause toxicity during the winter season, and, more particularly, to induce acute effects in *O. mykiss*. Furthermore, higher toxic responses seem to occur at physico-chemical treatment plants in summer and at unaerated lagoons in winter. Plants that use activated sludge and biofiltration treatment processes generally obtain the best results.

In order to understand these observations, the mean values of certain physico-chemical parameters that depend on the type of treatment or on biological activity were calculated. These values are presented in Table 4.14 by treatment type and season of the year. First, the high concentrations of ammonia nitrogen in the effluents of aerated lagoons in winter tend to confirm the previous observations and the role of ammonia nitrogen in the expression of toxicity at these plants (see sections 4.2.1.1 and 4.3.1). The mean in winter is the highest of all treatment types, while the mean in summer is one of the lowest. Second, relatively high concentrations of ammonia nitrogen are also noted in effluents of biofiltration plants, in both seasons.

Treatment processes without aeration equipment (unaerated lagoons and physico-chemical processes) yield the highest concentrations of sulfides, a good indication of the presence of high concentrations of hydrogen sulfide (H_2S). A concentration of total sulfide of 0.56 mg/L was measured during spring emptying (winter conditions) of the Martinville plant's unaerated lagoons. Relatively high concentrations of total sulfides were also measured in the effluent samples drawn in summer at the two plants with physico-chemical treatment processes (mean of 0.19 mg/L).

TABLE 4.14: MEAN VALUES OF CERTAIN CONVENTIONAL PHYSICO-CHEMICAL PARAMETERS BY TREATMENT TYPE AND SEASON

Treatment type	**NH_3-NH_4^+ (mg/L-N)**		**BOD_5 (mg/L)**		**COD (mg/L)**		**Total sulfides (mg/L)**	
	Winter	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**
Activated sludge	2.8	7.9	*	2.5	*	32.3	0.05	0.01
Biofiltration	10.0	9.2	30	5	85	49	0.03	0.05
Aerated lagoon	13.8	4.5	14.4	4.5	78.2	59.5	<	0.04
Unaerated lagoon	3.7	<	23	18	47	130	0.56	0.09
Physico-chemical	8.2	7.6	*	30.3	*	104.5	0.05	0.19

*: Too many results rejected to calculate a significant mean value.
<: All results were below the limit of detection.

The ammonia nitrogen and sulfide concentrations in continuous-draining unaerated lagoons in Quebec in winter[8] frequently exceed 10 mg/L and 2 mg/L, respectively, at the end of winter. An Ontario study shows similar results (Beak and Canviro, 1990). Also, relevant data from 1993 to 1995 on the monitoring of unaerated lagoons carrying out periodic emptying show high ammonia nitrogen concentrations, but rarely above 10 mg/L during the spring emptying process (MENV and MAMM, 1996). In the case of Martinville, the concentrations of ammonia nitrogen were lower than levels generally observed at plants with unaerated lagoons. The presence of H_2S could therefore explain, at least in part, the high toxic print obtained at this plant in winter.

At plants conducting physico-chemical treatment processes, sulfide concentrations are elevated in summer because of the higher temperatures of the wastewater. In addition, wastewater travel times in the CUM and Longueuil sewer systems are particularly long, which contributes to the production of hydrogen sulfide. These results and the design elements of these two plants could therefore account for part of the toxicity measured in summer. Plants with physico-chemical processes also obtained relatively high means for BOD_5 and COD, which may be explained by the absence of a biological treatment for such a process type.

Many studies corroborate these observations. In an Ontario study (Orr *et al.*, 1992), although no significant difference was noted between the activated sludge treatment plants (with or without tertiary filtration) and those with continuous-discharge unaerated lagoons, there were, nonetheless, fewer toxic responses in *O. mykiss* with the former treatment type. Also, the results obtained with effluents drawn in winter in unaerated lagoons were more toxic to *O. mykiss* (acute toxicity) and to *C. dubia* (chronic toxicity) than were the effluents drawn in summer. According to the authors, this could be explained by higher concentrations of ammonia nitrogen and sulfides in the effluents of unaerated lagoons with continuous discharge in winter.

In another study (Canviro Consultants, 1989), it was observed that activated sludge treatment plants were more effective in removing certain metals and organic substances than plants with primary treatment processes. An analysis of the overall results of the present study indicates that the quality of the effluents of activated sludge and biofiltration plants is generally superior.

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[8] In Quebec there are still eight municipal treatment plants with unaerated lagoons that carry out continuous discharge rather than periodic emptying.

Finally, certain other observations related to treatment type or season are worth mentioning. The addition of chlorine prior to tertiary filtration at the Magog plant does not seem to have contributed in any significant way to the expression of toxicity. Indeed, during all the toxicity tests (acute, chronic and PEEP Index) carried out at that plant, few toxic effects were observed in the test organisms. However, the plant is the only one carrying out tertiary filtration, and that has probably contributed to obtaining good results.

Although it is not possible to draw any conclusions about the effectiveness of the plants using physico-chemical processes to remove surfactants, this type of treatment has yielded the highest concentrations of surfactants. Values are always in the range of 2 mg/L of anionic surfactants and 1 mg/L of nonionic surfactants at the CUM plant, and always higher than these values at the Longueuil plant (see Table 3.10). With the exception of Cookshire and Farnham in winter, concentrations of surfactants at the other plants are always well below those measured at plants that employ a physico-chemical treatment process.

No apparent seasonal variation is associated with the results of the physico-chemical analyses, except for certain substances. In fact, the measured concentrations of the majority of parameters vary significantly from one sampling day to another, but do not show stronger variations from one season to the next. The only seasonal variations were obtained with substances that depend on biological activity for the treatment of wastewater, such as ammonia nitrogen and hydrogen sulfide (see discussion above and Table 4.14), and with substances used seasonally. Such is the case for chlorides used in road de-icing agents (sodium chloride and calcium chloride). The concentrations of chlorides presented in tables 3.6-W and 3.6-S indicate a significant increase in winter, in the range of 75% higher on average in summer for the plants overall. The increase is even greater at plants operating in municipalities with combined sewer systems and where de-icing salts are used in substantial quantities (CUO, CUQ, CUM, etc.). Finally, although our results cannot support this assumption, a seasonal variation is assumed with regard to pesticides.

In summary, then, it seems that, in winter, plants with aerated lagoons present a greater toxicity potential than plants using other types of treatment. One reason for this would be the higher concentrations of ammonia nitrogen in cold water, probably due to the decreased activity of nitrifying bacteria. Processes with no aeration (unaerated lagoons and physico-chemical treatment) could themselves present a greater toxic potential during certain periods of the year (during spring emptying of unaerated lagoons, and in summer for physico-chemical plants) because of the biological production of hydrogen sulfide in anaerobic conditions. An analysis of the overall results of the present study indicates that activated sludge and biofiltration plant effluents are generally of better quality. Lastly, a seasonal variation is recorded for certain substances that depend on biological activity for wastewater treatment, such as ammonia nitrogen and hydrogen sulfide, and those that are used seasonally, such as chlorides used in road de-icing agents.

4.4.2 Effects of the presence of industries on the sewer system

The impact of treatment types and seasons on effluent toxicity must be analysed based on the industrial BOD_5 load received at each plant. The data being only fragmentary, it is difficult to draw any clear conclusions from them. The analysis can nevertheless serve to determine whether plants with high or low industrial BOD_5 input present noticeable differences in toxicity.

Table 4.15 shows that all seasons combined, 50% of the results relative to maximum acute toxicity (6 of 12 results) are higher than 1 TUa at plants with substantial industrial inputs, compared to 19% (3 of 16 results) for plants with a low industrial input.

Also, the results for acute toxicity (tables 3.2-W and 3.2-S) indicate that only the effluents that were proven toxic (significant mortality percentage in *O. mykiss* or *D. magna* for the three daily samples), in winter and summer, originate from two plants with substantial industrial loading (Cookshire and Saint-Joseph-de-Beauce). The effluent of the Warwick plant, which receives a substantial industrial load as well, was also found to develop acute toxicity under winter conditions, but was not characterized under summer conditions.

TABLE 4.15: MAXIMUM ACUTE TOXICITY MEASURED BY INDUSTRIAL BOD_5 LOAD

Treatment process	**Treatment plant**	**Maximum TUa (1) relative to industrial BOD_5 inputs**	
		High inputs (winter - summer)	**Low inputs (winter - summer)**
Activated sludge	Farnham	nl - nl	
	La Prairie	nl - 1.9	
	Magog	nl	
	CUO		nl - nl
	Jonquière		nl - <1
Biofiltration	Châteauguay		nl - 1.5
	CUQ (East plant)		<1 - nl
Aerated lagoon	Cookshire	3.2 - 2.9	
	Saint-Joseph-de-Beauce	>1 - 1.4	
	Warwick	>1	
	Saint-Gédéon		>1 - <1
	Sawyerville		<1 - <1
Unaerated lagoon	Martinville		nl (2) - nl
Physico-chemical	CUM	nl - <1	
	Longueuil		nl - 3
Number of results above 1 TUa		**6/12 (50%)**	**3/16 (19%)**

(1): Highest result obtained of the three daily samples and the two acute toxicity tests performed.
(2): Non-lethal for *D. magna* and non-valid results for *O. mykiss*.
nl: Non-lethal.

The results for maximum chronic toxicity (Table 4.16) show that 83% of the results above 2 TUc (10 of 12 results) are associated with substantial industrial loads while the ratio drops to 56% (9 of 16 results) for plants with smaller industrial BOD_5 loads. The mean TUc's are also low for the latter plants. Of the eight plants with lower industrial inputs, three present a maximum chronic toxicity of more than 2 TUc in both seasons: one activated sludge plant (CUO) with 8 and 4 TUc, one biofiltration plant (CUQ) with > 17 and 4 TUc and one physico-chemical plant (Longueuil) with 11 and 16 TUc (see Table 4.16). However, it should be noted that there are a substantial number of industries connected to the sewer systems at these three plants, even though the industrial BOD_5 loads are relatively small. The effluents of the other plants having few industries connected to the sewer system (Jonquière, Châteauguay, Sawyerville, Saint-Gédéon and Martinville), all present a chronic toxicity of 2.2 TUc or less, with the exception of the samples drawn in summer at the Jonquière and Saint-Gédéon plants, where results of 16 TUc were obtained.

Table 4.16: Maximum Chronic Toxicity Measured by Industrial BOD$_5$ Load

Treatment process	**Treatment plant**	**Maximum TUc (1) relative to industrial BOD$_5$ inputs**	
		High inputs (winter - summer)	**Low inputs (winter - summer)**
Activated sludge	Farnham	4 - 1	
	La Prairie	5.9 - 4	
	Magog	2	
	CUO		8 - 4
	Jonquière		2 - 16
Biofiltration	Châteauguay		2 - 2
	CUQ (East plant)		>17 - 4
Aerated lagoon	Cookshire	16 - 17	
	Saint-Joseph-de-Beauce	17 - 16	
	Warwick	7.7	
	Saint-Gédéon		2 - 16
	Sawyerville		2.2 - 2
Unaerated lagoon	Martinville		1 - 1
Physico-chemical	CUM	(>100) - 33	
	Longueuil		11 - 16
Mean TUc:	**- with the CUM**	**18.6**	**6.6**
	- without the CUM	**9.1**	
Number of results above 2 TUc		**10/12 (83%)**	**9/16 (56%)**

(1): Highest result obtained of the three chronic toxicity tests performed.

At the Longueuil plant, industrial inputs have probably increased since the plant was first designed, and seem greater than what was expected, although no data is available to confirm this assumption. The acute toxicity and the high concentrations of surfactants (average of 15 mg/L of anionic surfactants and 4 mg/L of nonionic surfactants) measured during the summer of 1998 campaign can hardly be explained other than by a significant industrial load.

The influence of the industrial BOD$_5$ load on the toxic potential of municipal effluents was also evaluated using the toxic print as a measurement of genotoxicity. The mean toxic print calculated at the plants receiving substantial industrial loadings is greater than at plants associated with smaller industrial BOD$_5$ load (Table 4.17). It is also interesting to note that no high industrial-load plants have obtained a nil toxic print (the lowest result is 0.2 TUa.uvb^{-1} at La Prairie in winter), whereas there are 5 nil toxic prints out of the 16 results obtained at the plants with low industrial inputs.

TABLE 4.17: INFLUENCE OF INDUSTRIAL BOD_5 LOADING ON THE PEEP INDEX TOXIC PRINT

Industrial inputs	Number of results	Mean toxic print ($ATU.bvu^{-1}$)	Min - Max ($ATU.bvu^{-1}$)
Low inputs	16	11.0	0.0–81.5
High inputs	12	15.1	0.2–91.2

The overall results of the toxicity tests suggest that the industrial BOD_5 load may contribute significantly to the toxic potential of municipal effluents. Regarding aerated lagoons, the three plants categorized as having a substantial industrial BOD_5 load all have maximum chronic toxicity results greater than 7.7 TUc and maximum acute toxicity results above 1 TUa, while only one of the plants categorized as having a small industrial load presents a result above 2.2 TUc and one result above 1 TUa. It therefore seems that the industrial BOD_5 load has a greater effect than does treatment type on the toxicity tests used.

These results confirm those of Orr *et al.* (1992), which demonstrated that effluents associated with substantial industrial loads were more toxic to *O. mykiss*[9] (acute toxicity) and *C. dubia* (chronic toxicity) than effluents associated with low industrial loads.

The results of certain physico-chemical analyses were assessed on the basis of the industrial BOD_5 load. The mean results are presented in Table 4.18.

An analysis of the tabular data shows that higher values for BOD_5, COD and mineral oils and greases are obtained when there is a significant industrial input. The mean value for COD is particularly high, which means that substantial quantities of organic substances are found in the effluents of these plants. With regard to mineral oils and greases, the high mean value associated with a substantial industrial input can be explained by the results of the Cookshire plant alone, where concentrations of 16 to 17 mg/L were measured in winter.

As for metals, the industrial input does not seem to have a noticeable impact. The highest mean values are nevertheless found more often at plants with large industrial BOD_5 loads, except for aluminum, which is more influenced by dephosphatization (see Section 4.4.3). Apart from the data on the effluent samples drawn at the Longueuil plant in the summer of 1998, which may have been influenced by a particular phenomenon (probably a significant industrial discharge), the concentrations of surfactants are similar, although slightly higher at plants with large industrial loads.

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[9] In the case of trout, however, this trend was found to be statistically non-significant.

TABLE 4.18: MEAN VALUES OF CERTAIN PHYSICO-CHEMICAL PARAMETERS BY INDUSTRIAL BOD_5 LOAD

Parameter	Industrial BOD_5 inputs	
	Low inputs	**High inputs**
NH_3-NH_4^+ (mg/L-N)	6.9	8.0
BOD_5 (mg/L)	12	16
COD (mg/L)	56	86
Mineral oils and greases (mg/L)	0.18	1.42
Aluminum (mg/L)	0.53	0.34
Chromium (mg/L)	0.009	0.011
Copper (mg/L)	0.015	0.020
Lead (mg/L)	0.0006	0.0005
Silver (mg/L)	0.0011	0.0012
Zinc (mg/L)	0.021	0.050
Anionic surfactants (mg/L)	2.36 (2)	1.05
Nonionic surfactants (mg/L)	0.81	0.98
Total PCBs (ng/L)	4.75	8.92
Total PAHs (ng/L)	739	478
Chlorinated dioxins and furans (pg/L) (1)	0.122	0.524 (3)

(1): Chlorinated dioxins and furans are expressed in 2,3,7,8-TCDD equivalent.

(2): The mean value becomes 0.79 mg/L when eliminating the particularly high result obtained at Longueuil in 1998 (15 mg/L).

(3): The mean value becomes 0.104 pg/L when eliminating the particularly high result obtained at Cookshire in 1998 (2.6 pg/L).

The total PCB concentrations and the concentrations of chlorinated dioxins and furans are also higher where industrial loads are larger. These results are influenced by particularly high concentrations of PCBs and chlorinated dioxins and furans in the effluent of the Cookshire plant, where a large proportion of the wastewater comes from a textile mill.

Finally, total PAH concentrations are slightly higher with low industrial loads. In this one case, however, urbanization seems to play a more important role than industrial loading. The results presented in Table 3.12 show that total PAH concentrations at the CUM, Longueuil and CUQ (East plant) plants, which receive wastewater from highly urbanized combined sewers, range from 991 to 2731 ng/L, while means are lower than 250 ng/L everywhere else.

In summary, the industrial BOD_5 load appears to greatly increase the toxic potential of municipal wastewaters, and seems to be a determining factor in the potential toxicity of municipal effluents, even though effluents may be toxic where there is little or no industrial input.

4.4.3 Effects of chemical dephosphatization

The influence of chemical dephosphatization on the toxicity measured was also analysed in relation to the maximum acute toxicity (Table 4.19), the maximum chronic toxicity (Table 4.20), and the toxic print (Table 4.21). The overall results seem to indicate, on the surface, that effluents from plants that do no dephosphatization are slightly more toxic than those that employ this process. However, this trend is probably influenced more by other factors than by dephosphatization. Indeed, by eliminating the results of only three plants having aerated lagoons and large industrial inputs, characterized in winter (Cookshire, Saint-Joseph-de-Beauce and Warwick), the trend becomes non-significant in regard to the maximum TUa and TUc and it is even reversed with the mean toxic prints. This example shows that industrial input and the presence of ammonia nitrogen at higher concentrations in winter in aerated lagoons may have more influence on the toxicity measured than does chemical dephosphatization.

TABLE 4.19: MAXIMUM ACUTE TOXICITY MEASURED IN RELATION TO DEPHOSPHATIZATION

Treatment process	**Treatment plant**	**Maximum TUa [1] in relation with dephosphatization**	
		With dephosphatization	**Without dephosphatization**
Activated sludge	Farnham	nl	nl
	La Prairie		nl - 1.9
	Magog	nl	
	CUO	nl - nl	
	Jonquière		nl - <1
Biofiltration	Châteauguay	1.5	nl
	CUQ (East plant)		<1 - nl
Aerated lagoon	Cookshire		3.2 - 2.9
	Saint-Joseph-de-Beauce	1.4	>1
	Warwick		>1
	Saint-Gédéon		>1 - <1
	Sawyerville	<1	<1
Unaerated lagoon	Martinville	nl [2]	nl
Physico-chemical	CUM	nl - <1	
	Longueuil	nl - 3	
Number of results above 1 TUa		**3/12 (25%)**	**6/16 (38%)**

(1): Highest result obtained of the three daily samples and the two acute toxicity tests performed.

(2): Non-lethal for *D. magna* and invalid results for *O. mykiss*.

nl: Non-lethal.

TABLE 4.20: MAXIMUM CHRONIC TOXICITY MEASURED IN RELATION TO DEPHOSPHATIZATION

Treatment process	**Treatment plant**	**Maximum TUc (1) in relation with dephosphatization**	
		With dephosphatization	**Without dephosphatization**
Activated sludge	Farnham	1	4
	La Prairie		5.9 - 4
	Magog	2	
	CUO	8 - 4	
	Jonquière		2 - 16
Biofiltration	Châteauguay	2	2
	CUQ (East plant)		>17 - 4
Aerated lagoon	Cookshire		16 - 17
	Saint-Joseph-de-Beauce	16	17
	Warwick		7.7
	Saint-Gédéon		2 - 16
	Sawyerville	2	2.2
Unaerated lagoon	Martinville	1	1
Physico-chemical	CUM	(>100) - 33	
	Longueuil	11 - 16	
Mean TUc:	**- with the CUM**	**16.3**	**8.4**
	- without the CUM	**6.3**	
Number of results above 2 TUc		**7/12 (58%)**	**12/16 (75%)**

(1): Highest result obtained of the three chronic toxicity tests performed.

TABLE 4.21: INFLUENCE OF DEPHOSPHATIZATION ON THE PEEP INDEX TOXIC PRINT

Dephosphatization	**Number of results**	**Mean toxic print (ATU.bvu^{-1})**	**Min - Max (ATU.bvu^{-1})**
With	12	12.9	0.0–72.4
Without	16	15.9	0.2–91.2

Table 4.22 presents the mean values for total phosphorus, SM and the main metals detected at the five plants that used seasonal dephosphatization during the two characterization campaigns. In all these cases, alum served as the reagent. This table offers some appreciation of the effect of dephosphatization, assuming the seasonal effect is insignificant.

TABLE 4.22: EFFECT OF SEASONAL ALUM DEPHOSPHATIZATION: VARIATION OF THE CONCENTRATION OF CERTAIN PHYSICO-CHEMICAL PARAMETERS AND METALS WITH AND WITHOUT DEPHOSPHATIZATION

Treatment plant	Mean concentrations (mg/L) with and without alum dephosphatization [(1)] and variation (%) [(2)]																				
	Total phosphorus			SM			Aluminum			Iron			Copper			Chromium			Zinc		
	Wo	With	Var.	Wo	With	Var.	Wo	With	Var.	Wo	With	Var.	Wo	With	Var.	Wo	With	Var.	Wo	With	Var.
Farnham	*	0.2	—	11	10	- 9 %	0.78	0.690	- 12 %	1.26	0.343	- 73 %	0.048	0.016	- 67 %	(0.016)	0.0013	-108%	0.04	0.024	- 40 %
Châteauguay	*	0.66	—	11	10	- 9 %	0.06	0.587	+878%	1.30	0.250	- 81 %	0.040	0.014	- 65 %	(0.017)	0.0023	-114%	0.07	0.013	- 81 %
St-J.-de-Beauce	1.6	0.72	- 55 %	19	37	+ 95 %	<	0.057	—	1.23	0.497	- 60 %	0.012	0.010	- 17 %	0.002	0.004	+100%	<	<	—
Sawyerville	1.5	0.43	- 71 %	4	3.6	- 10 %	<	<	—	0.47	<	—	0.028	0.002	- 93 %	<	0.0142	—	0.02	<	—
Martinville	0.86	1.2	+ 40 %	46	18	- 61 %	0.040	0.253	+533%	0.40	0.193	- 52 %	<	0.003	—	0.022	0.001	- 95 %	<	0.003	—

*: result rejected
<: result below detection limit
( ): questionable result (quality control): to be considered with caution

(1): Summer dephosphatization at all treatment plants, except Martinville where dephosphatization occurred in spring (winter conditions).
(2): A negative variation indicates a decrease in mean concentration during dephosphatization.

An analysis of the data in Table 4.22 shows a negative variation in 80% of the results (20 results out of 25) of variation in the mean concentrations during the seasonal dephosphatization event. This suggests that dephosphatization has a beneficial effect, particularly on iron, copper, chromium and zinc concentrations, in addition to phosphorus. Surprisingly, dephosphatization appeared to have little effect on SM. At the Châteauguay and Martinville plants, alum dephosphatization (aluminum sulfide) seems to have significantly increased the aluminum concentrations in the effluent.

The CUM plant, which uses dephosphatization year-round, changed its chemical reagent between the winter of 1996 and summers of 1998 and 1999 sampling periods, switching from ferric chloride to alum. This change appears to have caused an increase in aluminum concentrations in the effluent (from 0.140 to 0.867 mg/L), but a decrease in iron concentrations (from 1.750 to 0.250 mg/L) (see Table 4.23). It should be mentioned that during the 1995–97 period, the CUM measured concentrations of approximately 1.5 mg/L for each of these parameters in its effluent (Deschamps *et al.*, 1998; Purenne, 1998). The metal serving as reagent seems therefore to be present at the outfall at concentrations on the same order of magnitude as at the inlet, but appears to have a beneficial effect on the other metal. Moreover, for 1995, 1996 and 1997, the CUM plant measured increases in iron concentrations of 37%, 5% and 19%, respectively, at the outfall, compared to the concentration at the inlet when dephosphatization was carried out with ferric chloride (Deschamps *et al.*, 1998; Purenne, 1998).

TABLE 4.23: MEAN ALUMINUM AND IRON CONCENTRATIONS MEASURED IN THE EFFLUENT OF THE CUM PLANT DURING EPISODES OF FERRIC CHLORIDE AND ALUM DEPHOSPHATIZATION

Treatment plant	Ferric chloride dephosphatization (winter 1996)		Alum dephosphatization (summer 1998 and 1999)	
	Aluminum (mg/L)	Iron (mg/L)	Aluminum (mg/L)	Iron (mg/L)
CUM	0.140	1.750	0.867	0.250

The same observation can be made by comparing the mean of all aluminum and iron concentrations at plants that were not using dephosphatization with mean concentrations at plants that did perform alum or iron dephosphatization (ferric chloride or sulfide). Table 4.24 shows that the aluminum concentration increases by 350%, from 0.18 to 0.81 mg/L, for all the plants using alum for dephosphatization, compared to those that do no dephosphatization at all. For these same plants, there has been a beneficial effect on the total mean concentration of iron, since the value dropped from 0.55 to 0.37 mg/L. For plants that use iron for dephosphatization, there was also an increase of some 200% in the concentration of the metal serving as a coagulant, going from 0.55 to 1.71 mg/L of iron. However, there was no beneficial effect on the aluminum concentration, one reason being a very high aluminum concentration measured at the CUO plant during the winter characterization, which increases the mean.

TABLE 4.24: MEAN ALUMINUM AND IRON CONCENTRATIONS MEASURED AT PLANT EFFLUENTS IN RELATION TO DEPHOSPHATIZATION

Treatment plant (winter and summer results)	**Mean concentration (mg/L)**	
	Aluminum	**Iron**
All plants without dephosphatization	0.18	0.55
All plants with alum dephosphatization	0.81	0.37
All plants with iron dephosphatization	1.42	1.71

To sum up, then, in addition to removing phosphorus, chemical dephosphatization appears to have a beneficial effect on metal removal. On the other hand, though, it appears to cause an increase in the concentration of the metal serving as a coagulant. Chemical dephosphatization may also have a beneficial effect on the toxic potential of municipal effluents, although it is impossible to say so with any certainty, based on our analysis, since the toxicity results appear to be influenced much more by the type of treatment used, the season and the industrial load, than by chemical dephosphatization.

5 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

OBJECTIVES AND INTERPRETATIVE LIMITATIONS OF THE STUDY

The objective of the study was to obtain a comprehensive and representative snapshot of the toxic potential of municipal treatment plant discharges — that is, to assess the toxicity of undiluted effluents without taking account of the particularities of receiving environments or loads discharged. The approach adopted for this study made it possible to compare the municipal effluents on a common basis in order to:

- assess end-of-pipe toxicity (acute or chronic) of treated wastewater discharges of municipal treatment plants;
- point up the substances that are the likely sources of the measured toxicity;
- identify the common causes of toxicity and the effect of certain factors that might influence effluent toxicity.

This approach, however, does not allow for a cause-and-effect link to be made between measured toxicity and potential effects on the environment. The toxicity of various contaminants may be modified due to certain environmental characteristics of receiving environments, such as water hardness, pH, temperature, the presence of other substances, degradation of parent products into more or less toxic by-products, the health of populations present, etc. Concentrations alone are inadequate to assess the apprehended impact of an effluent on its receiving environment; consideration must also be given to loads discharged, and to the physical (flow, hydrodynamics, deposition zones) and chemical characteristics of the specific receiving environment.

This study looked only at the toxicity of effluents without taking account of other possible impacts of municipal wastewater discharges on a body of water. The physical impacts of effluents and overflow water [10] on habitats, as well as the thermal, aesthetic and microbiological impacts were not assessed. The toxicity aspect of overflow water was not addressed, either.

Lastly, due to the low sampling rate, we were unable to process the results statistically or to characterize the recognized variability of municipal wastewaters.

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[10] The term overflow, in this context, means the volumes of excess water released untreated during episodes of heavy rainfall or spring snowmelt by municipal sewers.

EXPERIMENTAL APPROACH AND TOOLS FOR ASSESSING TOXIC POTENTIAL

The 15 municipal wastewater treatment plants selected are representative of the main treatment processes used in Quebec. They were characterized over a period stretching from 1996 to 1999, mostly over two seasons, winter and summer. During these sampling campaigns, all plants functioned normally and, overall, respected the discharge requirements (BOD_5, SM and TP) for which they were designed.

Sampling was carried out over three inconsecutive days for each season. In all, seven toxicity tests were performed and up to 26 conventional physico-chemical parameters, 19 metals and eight families of chlorinated and unchlorinated organic substances were analysed in the samples drawn. While the comparison of results for certain substances may be biased due to changes in the analytical profile over the course of the project, our experimental protocol produces a representative snapshot of the quality and potential toxicity of municipal wastewaters under normal plant operating conditions.

Toxic potential is assessed using a complementary, three-pronged approach: studying the amplitude of exceedances of water quality criteria for the chemicals analysed, studying the amplitude of exceedances of overall toxicity criteria for toxicity tests, and studying the compilation of the toxic prints, which are toxicity-measuring components of the PEEP Index. With this approach, the substances proper to municipal wastewater treatment plants can be identified, as can the toxicity of the effluents and the substances likely to be responsible. The importance of treatment-process type, effect of industrial-source loading, presence of a chemical dephosphatization process or effectiveness of treatment by season of the year can also be determined.

RESULTS OF PHYSICO-CHEMICAL ANALYSES AND TOXIC POTENTIAL BASED ON THE AMPLITUDE OF EXCEEDANCES OF WATER-QUALITY CRITERIA FOR SUBSTANCES ANALYSED

The variable quality of municipal effluents was recognized upon examining the analytical results. The toxic responses and measured concentrations of several substances differed significantly from one sampling day to the next. Seasonal variations were also observed for some substances, including those that depend upon biological activity during wastewater treatment, such as ammonia nitrogen and hydrogen sulfide, or where their use is seasonal, like the chlorides used in road de-icing agents.

The substances most frequently detected in samples drawn at the 15 plants are shown in Table 5.1. Since they were detected in more than 85% of samples analysed, the results suggest that these substances are likely to be found in the wastewaters of a number of plants in Quebec.

Although these substances are practically ubiquitous in the wastewaters of all 15 plants, they are not necessarily found in effluent at concentrations deemed toxic or harmful. Many did not exceed water quality criteria (sulfates, barium, boron, and herbicides) or showed a few specific low-range exceedances (chlorides, fluorides, iron, and PAHs).

TABLE 5.1: SUBSTANCES DETECTED IN MORE THAN 85% OF SAMPLES ANALYSED

Nutrients	**Major ions**	**Metals**	**Organic substances**
Ammonia nitrogen Nitrites and nitrates Phosphorus	Chlorides Fluorides Sulfates	Aluminum Arsenic Barium Boron Chromium Copper Iron Mercury (1)	PCBs Chlorinated dioxins and furans Herbicides (2) PAHs Anionic surfactants

(1): Frequency exceeds 85% in samples drawn in 1998–99 due solely to the use of a method with a better detection limit.

(2): Pesticides (herbicides and insecticides) were analysed in 42 samples drawn from two plants alone. Only the herbicides 2,4-D and mecoprop were detected in more than 85% of samples.

Of those pesticides used in urban applications, seven were detected in effluents of the two treatment plants where these analyses were performed. These were herbicides 2,4-D, mecoprop and dicamba, all of which are contained in commercial lawn treatment mixtures, as well as the insecticides diazinon, carbaryl, malathion and chlorpyrifos. Other pesticides applied on field crops were also detected: in municipal effluents; their presence is probably attributable to atmospheric transport from the farmbelts surrounding urban areas. In summer, concentrations of pesticides, and most especially herbicides, appear to swell during rainfall events due to urban runoff. These results have been corroborated by other studies conducted in Ontario and the U.S.

An examination of the amplitude of exceedances of the quality criteria for the protection of aquatic life show that there are frequent exceedances for certain substances, with some attaining high amplitudes (> 10). This is true for ammonia nitrogen, phosphorus, hydrogen sulfide, aluminum, silver, chromium, copper, two insecticides (diazinon and chlorpyrifos) and, most especially, surfactants. Indeed, wherever nonionic and anionic surfactants were detected, they exceeded the water quality criteria, and the exceedances are substantial in the majority of cases. The presence of these substances at such concentrations suggests that municipal wastewater presents a toxic potential that is harmful to aquatic life in the long term, particularly in watercourses with only a moderate assimilative capacity.

Other substances known to be toxic and highly bioaccumulable appear to be ubiquitous, and were detected at significant concentrations relative to the quality criteria for the prevention of contamination of aquatic organisms. This is the case for PCBs and chlorinated dioxins and furans, and, to a lesser extent, mercury. These substances can contaminate the flesh or tissue of fish, molluscs and crustaceans, making them unfit for unrestricted consumption. These substances can be even more harmful to fish-eating land animals, as the quantity of fish they consume is greater than that consumed by humans and because they eat the entire organism, including those tissues where bioaccumulation is greater than in flesh.

The sources of these bioaccumulable substances in municipal wastewaters, especially PCBs and chlorinated dioxins and furans, are many and complex. Other than industrial discharges, these substances may come from relatively distant atmospheric sources and contaminate urban runoff waters as well as the aquatic receiving environments from which municipalities draw their water supply. Only mass balance studies of the municipal network would enable us to determine the inputs of various sources being channelled to municipal treatment plants.

TOXIC POTENTIAL FOR AQUATIC LIFE BASED ON TOXICITY TESTS OF THE MENV APPROACH FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT

With acute toxicity tests, there were few exceedances of the overall toxicity criteria of one acute toxic unit (TUa) and they were of low amplitude, in the majority of cases. More than half of treatment plants (53%) had no result above 1 TUa. Twenty-two percent of samples were toxic to rainbow trout, with 11% being toxic to *Daphnia magna*. For purposes of comparison, a similar study in Ontario in 1992 shows corresponding percentages of 56% and 27%, respectively. These differences mainly have to do with the fact that, unlike many plants in Ontario, Quebec treatment plants use no chlorine treatment to disinfect their wastewater.

Ammonia nitrogen, at concentrations greater than 10 mg/L, appears to be mainly responsible for the acute toxicity measured. Surfactants may be the second most generalized contaminant while nitrites are suspected at one plant. The presence of pesticides in summer could be another cause of toxicity.

Chronic toxicity effects were measured in the undiluted effluents of almost all the plants, but, overall, exceedances of the overall toxicity criteria of 1 TUc are of low amplitude (responses of 1 to 2 TUc), which suggests that there will be few or no effects on the environment once the effluent mixes into the watercourse. All seasons combined, a little over one-third of the plants obtained results above 10 TUc, thereby making these effluents potentially harmful to aquatic life in watercourses with a weak assimilative capacity. One plant obtained results above 30 TUc.

Almost all the samples stimulated algal growth. This positive response in the algae *Selenastrum capricornutum* was not quantified in terms of toxic units, but it does nonetheless indicate the potential harm of the eutrophication process for aquatic life.

Those substances most likely to have contributed to the chronic toxicity measured are ammonia nitrogen, a few metals (mainly copper, chromium and aluminum), surfactants and, probably, certain pesticides including diazinon and chlorpyrifos. In some specific cases, nitrites, cyanides or hydrogen sulfide might have played a role. In all these cases, though, the expression of chronic effects coincides with the simultaneous presence of several substances at concentrations greater than safe limits.

Toxicity identification evaluations (TIEs) are the only way to determine, on a case-by-case basis, which substances are responsible for chronic and acute toxicity.

TOXIC POTENTIAL BASED ON TOXIC PRINTS OF THE PEEP INDEX

No threshold or criterion has yet been established to indicate a worrisome or harmful level relative to toxic prints of the Potential Ecotoxic Effects Probe (PEEP) Index. Although it is impossible to reach any conclusions about the toxic potential of municipal effluents in terms of toxic prints, this tool does allow us to better define wastewater quality, and has proven useful to interpreting the results.

The genotoxicity test was particularly sensitive to municipal wastewater, with toxic responses observed at more than two out of three plants. These results suggest that undiluted municipal effluents may contain substances at concentrations capable of altering bacterial DNA.

INFLUENCE OF SEASON, TREATMENT TYPE, INDUSTRIAL LOADING AND DEPHOSPHATIZATION ON TOXIC POTENTIAL

The results of the study indicate that the toxic potential of municipal effluents in Quebec varies from one plant to another. Effluents of aerated lagoons that were characterized during winter operating conditions are often acutely toxic for rainbow trout because of the elevated concentrations of ammonia nitrogen. Treatment processes that don't include aeration equipment (unaerated lagoons and physico-chemical processes) may present a higher toxic potential at certain times of the year (during spring emptying for unaerated lagoons and in summer for physico-chemical treatment) due to the biological production of hydrogen sulfide under anaerobic conditions.

Plant effluents that are subject to major industrial loading were, overall, more toxic than those of plants with low industrial inputs. Our results show that industrial inputs appear to be a determining factor in the toxic potential of municipal effluents, although effluents may be toxic where there is little or no industrial input.

In addition to removing phosphorus, chemical dephosphatization had a beneficial effect on the removal of metals. In contrast, though, it does seem to lead to an increase in the concentration of metal serving as a coagulant. Although chemical dephosphatization also appears to have a beneficial effect on the toxic potential of municipal effluents, it is impossible to say so with any certainty, since the toxicity test results obtained in this study are much more influenced overall by treatment type, season of the year and industrial load than by dephosphatization.

CONCLUSION ON ANALYTICAL METHODS AND SAMPLES USED

The use of the best analytical techniques made it possible to lower detection limits and thus obtain a better snapshot of the quality of municipal wastewater, in addition to producing results that are comparable to defined safety limits (water quality criteria) for several substances and metals. Our use of these best techniques also allowed us to point up the presence of substances rarely quantified in this type of effluent (e.g. PCBs and chlorinated dioxins and furans).

Unlike studies conducted elsewhere, this study targeted pesticides that are likely to be found in the urban environment. This proved useful to the task of selecting the appropriate analytical methods to point up the presence of these pesticides in municipal wastewaters.

In the case of municipal effluents, scanning analytical methods for semi-volatile and volatile organic substances were found to be lacking in specificity and resolution. It might be better to target a small number of substances, e.g. the 20-odd VOCs used in laboratory accreditation processes.

The present study confirmed once again the importance of using a number of different toxicity tests to adequately assess effluent toxicity because of the variability of contaminants present in samples, which can a reaction in a given species but not in an other.

GENERAL CONCLUSIONS

The municipal cleanup initiatives begun in Quebec in 1979 have had positive effects on the quality of watercourses. Treatment plants built in the context of these cleanup programs were specifically designed to reduce the main contaminants contained in municipal wastewaters (i.e. conventional parameters: BOD_5, SM, phosphorus and fecal coliforms). Although these plants can attain a certain yield for the removal of other contaminants potentially contained in municipal wastewaters, they cannot eliminate them completely.

This study characterized the effluents of 15 different municipal treatment plants. The toxicity test results show that although the treated wastewaters of almost all the plants studied are toxic, they expressed, with only a few exceptions, low amplitude toxicity to the test species.

The main substance responsible for the toxicity measured appears to be ammonia nitrogen, at concentrations above 10 mg/L. During winter, when the nitrification process is reduced, concentrations of ammonia nitrogen are higher, especially in aerated lagoons. Anionic surfactants are next, followed, to a lesser extent, by nonionic surfactants. Surfactants are organic molecules that enter into the composition of hundreds of products used, among other things, as cleaning agents for both domestic and industrial purposes. Finally, other substances, like certain pesticides and metals, could also be responsible for the toxicity measured.

This study points up the ubiquitousness of a number of substances in the municipal wastewaters of 15 treatment plants, including certain organic substances rarely quantified in other studies and found at concentrations that could impair use of the water. These are, namely, surfactants, PCBs and chlorinated dioxins and furans. Certain pesticides may be added to the list in summer during rainfall events. However, to assess the actual impact of these substances, discharge loads must be considered and, in each case, sound information held on the biophysical and chemical characteristics of the respective receiving environments.

The significance of industrial inputs to treatment plants appears to be a determining factor in the toxic potential of municipal effluents, even though effluents may be toxic where there is little or no industrial input.

RECOMMENDATIONS

Those municipal treatment plants that do respect their discharge requirements may have a difficult time further reducing the toxicity of their effluents. Adding equipment to this end may be costly and relatively ineffective given the significance of the discharges and the dilution of contaminants. *The focus would be better directed toward at-source reduction* where intervention may be much cheaper and more effective, particularly with regard to industrial-source contaminants. In this way, public-education initiatives should also be envisaged to reduce the use of certain contaminants that are widely employed for domestic purposes, especially pesticides and surfactants.

Nonetheless, *other solutions must be found to problems inherent to certain treatment types in order to reduce effluent toxicity*. This is the case, for example, for aerated lagoons having concentrations of ammonia nitrogen that exceed 10 mg/L in winter. Although the selection criteria in this study rejected plants with elevated concentrations of ammonia nitrogen, we were nonetheless able to establish a link between this parameter and effluent toxicity. Several Quebec treatment plants show elevated concentrations of ammonia nitrogen. Based on all the data collected since 1995, 16 municipal treatment plants have obtained at least one result above 50 mg/L of ammonia nitrogen, and 27 plants (or 5% of plants in Quebec) obtained a general average greater than 10 mg/L. The highest concentrations are generally due to the presence of industrial plants, especially the agri-food sector, for which at-source reductions remain the best solution.

Just as in previous studies, the present study demonstrates that municipal treatment plants can be a source of contaminants at levels that are sometimes toxic or harmful to use of the water. We are not in a position to make any determinations on the impact of these effluents on their respective receiving environments. To do so, *the sampling frequency of a complete characterization of the effluents must be higher in order to consider variability, and the results should be analysed against environmental discharge objectives (EDO)*. EDOs are based on the quality criteria applicable to different uses of the water, and they take account of specifics of the effluent (especially flow rate) and characteristics of receiving environments.

The establishment of EDOs for the substances present in effluents and for overall toxicity, as measured by toxicity tests, is proving to be essential to determining the problems apprehended in a specific environment and to identifying the substances responsible, on a case-by-case basis. However, *municipal effluents are not the sole source of contamination of receiving environments. Inputs should be assessed as a function of other sources* such as sewer overflows of untreated wastewater, urban runoff, agricultural pollution, industries not connected up to municipal sewer systems, atmospheric deposition, upwellings of water on contaminated land, and sanitary landfill sites.

Lastly, *basic data on the water quality of receiving environments is also vital to this process.* Where it exists at all, real data on the majority of toxic substances in most water bodies is incomplete. *The MENV should continue to seek more such information and target problem substances on a priority basis.*

BIBLIOGRAPHY

Amato, J. R., D. I. Mount, E. J. Durhan, M. T. Lukasewycz, G. T. Ankley, and E. D. Robert. 1992. An example of the identification of diazinon as a primary toxicant in an effluent. *Environ. Toxicol. Chem.* 11: 209-216.

Ankley, G. T., G. S. Peterson, J. R. Amato, and J. J. Jenson. 1990. Evaluation of sucrose as an alternative to sodium chloride in the Microtox assay: Comparison to fish and cladoceran tests with freshwater effluents. *Environ. Toxicol. Chem.* 9: 1305-1310.

APHA, AWWA, and WEF. 1995. *Standard Methods for the Examination of Water and Wastewater*. 19th ed., American Public Health Association, American Water Works Association and Water Environment Federation. Washington, D.C.

APHA, AWWA, and WEF. 1992. *Standard Methods for the Examination of Water and Wastewater*. 18th ed., American Public Health Association, American Water Works Association and Water Environment Federation. Washington, D.C.

Asami, M., N. Suzuki, and J. Nakanishi. 1996. Aquatic toxicity emission from Tokyo: Wastewater measured using marine luminescent bacterium, *Photobacterium phosphoreum*. *Wat. Sci. Tech.* 33(6): 121-128.

Bailey, H.C., J. Elphick, L. Gidding, R. Krassoi, A. M. Mulhall, L. Todhunter, P. Hunt, Bickford, and A. Lovell. 1999. "Results of whole effluent toxicity tests and toxicity identification evaluations conducted on sewage treatment plant effluent discharged into the Hawkesbury-Nepean river system, New South Wales, Australia." *In* Proceedings of the 25th Annual Aquatic Toxicity Workshop, October 18-21, 1998, Quebec, Quebec. Canadian Technical Report of Fisheries and Aquatic Sciences No. 2260. Fisheries and Oceans Canada.

Beak Consultants Limited and Canviro Consultants. 1990. *Review of Aquatic Toxicity and Environmental Impact of Ontario Sewage Treatment Plant Effluents*. Report prepared for Environment Canada and the Ontario Ministry of the Environment. ISBN 0-7729-6284-7.

Bermingham, N. and D. Boudreau. 1994. *Synthèse de l'application du barème d'effets écotoxiques potentiels (BEEP) et recommandations d'orientation pour son développement*. Environment Canada, Quebec Region, Environmental Conservation, St. Lawrence Centre. Technical and scientific Report. 30 pages.

Berryman, D. 1996a. *Le bassin versant de la rivière Saint-François: contamination de l'eau par les métaux et certaines substances organiques toxiques*. Ministère de l'Environnement et de la Faune, Direction des écosystèmes aquatiques. 43 pages + appendices. Envirodoq EN960252, ISBN 2-550-30434-9.

Berryman, D. 1996b. *Le bassin de la rivière Châteauguay: contamination de l'eau par les métaux et certaines substances organiques toxiques.* Ministère de l'Environnement et de la Faune, Direction des écosystèmes aquatiques. 34 pages + appendices. Envirodoq EN960453, ISBN 2-550-30756-9.

Berryman, D. and A. Nadeau. 1999. "Le bassin de la rivière Yamaska: contamination de l'eau par des métaux et certaines substances organiques toxiques" In: *Le bassin de la rivière Yamaska: l'état de l'écosystème aquatique – 1998.* Ministère de l'Environnement, Direction des écosystèmes aquatiques. Pages 3.1 to 3.44 + appendices. Envirodoq EN990224, ISBN 2-550-34488-X.

Berryman, D. and A. Nadeau. 1996. "La rivière Chaudière: contamination de l'eau par les métaux et certaines substances organiques toxiques" In: *Le bassin de la rivière Chaudière: l'état de l'écosystème aquatique – 1996.* Ministère de l'Environnement et de la Faune, Direction des écosystèmes aquatiques. Pages 3.1 to 3.37 + appendices. Envirodoq EN98-3900-04, ISBN 2-550-33079-X.

Berryman, D. and A. Nadeau. 1995. "Le bassin de la rivière Richelieu: contamination de l'eau par des métaux et certaines substances organiques toxiques" In: *Le bassin versant de la rivière Richelieu: l'état de l'écosystème aquatique – 1995.* Ministère de l'Environnement et de la Faune, Direction des écosystèmes aquatiques. Pages 2.1 to 2.44 + appendices. Envirodoq EN980604, ISBN 2-550-33225-3.

BEST – Bureau d'étude sur les substances toxiques. 1980. *Vue d'ensemble sur les substances toxiques. Biphényles polychlorés.* Ministère de l'Environnement du Québec. Report BEST-15. 55 pages.

Blaise, C., G. Sergy, P. Wells, N. Bermingham, and R. van Coillie. 1988. Biological testing-development, application, and trends in Canadian Environmental Protection Laboratories. *Tox. Assess.* 3: 385-406.

Blaise, C., R. Van Coillie, N. Bermingham, and G. Lacombe. 1987. Comparaison des réponses toxiques de trois indicateurs biologiques (bactéries, algues, poissons) exposés à des effluents de fabriques de pâtes et papiers. *Rev. Int. Sci. Eau* 3(1): 9-17.

Bombardier M. and/or M. Harwood (1996 to 1999). *Caractérisation bioanalytique des eaux usées municipales: Station d'épuration de ... (Québec).* Environment Canada, Quebec Region, Environmental Conservation, St. Lawrence Centre (series of 30 reports relevant to the 30 bioanalytical characterizations of municipal wastewater treatment plant effluents of the present study).

Brochu, C. 1997. *Note technique*, Centre d'expertise en analyse environnementale du Québec, 25 juillet 1997, 4 pages.

Burgess, R. M., K. T. Ho, M. D. Tagliabue, A. Kuhn, R. Comeleo, P. Comeleo, G. Modica, and G. E. Morrison. 1995. Toxicity characterization of an industrial and a municipal effluent discharging to the marine environment. *Mar. Poll. Bull.* 30(8): 524-535.

Burkhard, L. P. and J. J. Jenson. 1993. Identification of ammonia, chlorine, and diazinon as toxicants in a municipal effluent. *Arch. Environ. Toxicol.* 25: 506-515.

Canviro Consultants. 1989. *Thirty-Seven Municipal Water Pollution Control Plants: Pilot Monitoring Study*. Report prepared for the Ontario Ministry of the Environment, Water Resources Branch, Mississauga, Ontario. Canviro Ref. K123590.A0.

Carrier, G. 1991. *Réponse de l'organisme humain aux BPC, dioxines et furannes et analyse des risques toxiques*. Centre de Diffusion du livre spécialisé, Montréal. 484 pages.

CCME – Canadian Counsil of Ministers of the Environment. 1999. *Canadian Recommendations for the Quality of the Environment*. Winnipeg. ISBN 1-896997-34-1.

CCREM – Canadian Counsil of Resource and Environment Ministers. 1994. *Recommendations for Water Quality in Canada*. Environment Canada, Ecosystem Sciences and Evaluation Directorate, Water Quality Branch, Water Quality Objectives Division, Ottawa, Ontario. 6 chapters and 17 appendices.

CEAEQ – Centre d'Expertise en Analyses Environnementales du Québec. 1997. *Détermination des Polychloro Dibenzo-p-dioxines et Polychloro Dibenzo-furanes (PCDD/PCDF)*. Méthode MA-400-DF 1.0.

Correia, V.M. *et al.* (1994). *Characterization of Textile Wastewaters: A Review*. Publications Division Selper Ltd.

Cossa, D., T. T. Pham, B. Rondeau, B. Quémerais, S. Proulx, and C. Surette. 1998. *Bilan massique des contaminants chimiques dans le fleuve Saint-Laurent*. Environment Canada, Quebec region, Preservation of the environment, St. Lawrence Centre. Technical and Scientific Report ST-163, 258 pages.

Cossa, D., B. Rondeau, T. T. Pham, S. Proulx, and B. Quémerais. 1996. *Principes et pratiques d'échantillonnage d'eaux naturelles en vue du dosage de substances et d'éléments présents à l'état de traces et ultra-traces*. Environment Canada, Quebec Region, Environmental Conservation, St. Lawrence Centre. Working Document DT-5, 28 pages.

Costan, G., N. Bermingham, C. Blaise, and J. F. Férard. 1993. Potential ecotoxic effects probe: A novel index to assess and compare the toxic potential of industrial effluents. *Environ. Toxicol. and Wat. Qual.* 8(2): 115-140.

Deschamps, G., C. Juteau, and P. J. Cejka. 1998. *Évolution des contaminants toxiques dans les eaux usées à la station d'épuration de la Communauté urbaine de Montréal en 1995 et 1996.* Communauté urbaine de Montréal, Service de l'environnement, Réseau de suivi écologique. RSÉ 98-01, 50 pages.

Dy, N. 1985. *La problématique des dioxines et des furannes au Québec*. Ministère de l'Environnement, Direction de l'assainissement de l'air. 73 pages. Envirodoq 850797, ISBN 2-550-12664-5.

Environment Canada. 1997. *Review of the Impacts of Municipal Wastewater Effluents on Canadian Waters and Human Health.* Ecosystem Science Directorate, Environmental Conservation Service (ECS). 84 pages.

Environment Canada. 1996a. *Manuel des procédures d'opérations normalisées: Filtration de grands volumes d'échantillons d'eau de surface.* Ecotoxicology and Environmental Chemistry, St. Lawrence Centre. LO-FIL-960920.

Environment Canada. 1996b. *Manuel des procédures d'opérations normalisées: Extraction à grand volume (EGVA) avec le dispositif Goulden.* Ecotoxicology and Environmental Chemistry, St. Lawrence Centre, LO-GOU-960331.

Environment Canada. 1996c. *Manuel des procédures d'opérations normalisées: Concentration d'extraits organiques.* Ecotoxicology and Environmental Chemistry, St. Lawrence Centre, LO-COC-960331.

Environment Canada. 1996d. *Guide de caractérisation des eaux usées industrielles.* Ecotoxicology and Environmental Chemistry, St. Lawrence Centre.

Environment Canada. 1995. *Préparation et exécution des essais de toxicité sur la bactérie luminescente* Vibrio fischeri - *phase liquide.* Conservation and Protection, Quebec Region, St. Lawrence Centre. LB-MIL-931007-1, 21 pages (March 1995 publication).

Environment Canada. 1993. *Test de génotoxicité avec la bactérie* Escherichia coli *PQ37 (SOS Chromotest): protocole pour échantillons aqueux.* Version 1.2, Conservation and Protection, Quebec Region, St. Lawrence Centre. 20 pages.

Environment Canada. 1992a. *Méthode d'essai biologique: essai de toxicité sur la bactérie luminescente* Photobacterium phosphoreum. Conservation and Protection, Ottawa, Report SPE 1/RM/24. 67 pages.

Environment Canada. 1992b. *Méthode d'essai biologique: essai d'inhibition de la croissance de l'algue d'eau douce* Selenastrum capricornutum. Conservation and Protection, Ottawa, Report SPE 1/RM/25. 43 pages.

Environment Canada. 1992c. *Méthode d'essai biologique: essai de reproduction et de survie sur le cladocère* Ceriodaphnia dubia. Conservation and Protection, Ottawa, Report SPE 1/RM/21. 78 pages.

Environment Canada. 1992d. *Méthode d'essai biologique: essai de croissance et de survie sur des larves de Tête-de-boule*. Conservation and Protection, Ottawa, Report SPE 1/RM/22. 72 pages.

Environment Canada. 1990a. *Méthode d'essai biologique: essai de létalité aiguë sur* Daphnia *spp*. Conservation and Protection, Ottawa, Report SPE 1/RM/11. 61 pages.

Environment Canada. 1990b. *Méthode d'essai biologique: méthode de référence pour la détermination de la létalité aiguë d'effluents chez* Daphnia magna. Conservation and Protection, Ottawa, Report SPE 1/RM/14. 22 pages.

Environment Canada. 1990c. *Méthode d'essai biologique: méthode de référence pour la détermination de la létalité aiguë d'effluents chez la Truite arc-en-ciel*. Conservation and Protection, Ottawa, Report SPE 1/RM/13. 22 pages.

Environment Canada. 1990d. *Méthode d'essai biologique: essai de létalité aiguë sur la Truite arc-en-ciel*. Conservation and Protection, Ottawa, Report SPE 1/RM/9. 53 pages.

Environment Canada. 1990e. *Document d'orientation sur le contrôle de la précision des essais de toxicité au moyen de produits toxiques de référence*. Conservation and Protection, Ottawa, Report SPE 1/RM/12. 91 pages.

Environment Canada. 1989. *L'industrie textile canadienne et l'environnement:- Une évaluation*. Conservation and Protection, Ottawa, Report SPE 5/TX/1.

Environment Canada. 1981. *Les BPC et l'équipement électrique*. Environmental Impact Control Directorate, Environmental Protection Service. 56 pages.

Fisher, D. J., M. H. Knott, B. S. Turley, L. T. Yonkos, and G. P. Ziegler. 1998. Acute and chronic toxicity of industrial and municipal effluents in Maryland, U.S. *Wat. Environ. Res*. 70(1): 101-107.

Goulden, P. D. and D. H. J. Anthony. 1985. *Design of a large sample extractor for the determination of organics in water*. National Water Research Institute, Canada Center for Inland Waters, Burlington Ontario. NWRI Contribution Number 85-121.

Government of Canada. 2000. *Les pesticides: Un choix judicieux s'impose pour protéger la santé et l'environnement*. Report from the Standing Committee on Environment and Sustainable Development.

Horstmann, M. and M. S. McLachlan. 1995. Results of an initial survey of polychlorinated dibenzo-p-dioxin (PCDD) and dibenzofurans (PCDF) in textiles. *Chemosphere* 31(2): 2579-2589.

Horstmann, M. and M. S. McLachlan. 1994. "Textiles as a source of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F) in human skin and sewage sludge. *Environ. Sci. and Pollut. Res.* 1(1):15-20.

IARC – International Agency for Research on Cancer. 1987. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans - Overall Evaluations of Carcinogenicity: an Updating of IARC Monographs.* Volumes 1 to 42, Supplement 7, World Health Organization.

Jobling, S., M. Nolan, C. R. Tyler, G. Brighty, and J. P. Sumpter. 1998. Widespread sexual disruption in wild fish. *Environ. Sci. and Technol.* 32(17): 2498-2506.

Jones-Lee, A. and G. F. Lee. 1999. Devoted to stormwater-runoff water quality management issues. *Stormwater Runoff Water Quality Science/Engineering Newsletter* 1(5): 21 p.

Kimbrough, R. A. and D. W. Litke. 1999. *Pesticide Occurrence in a Small Urban and a Small Agricultural Basin, South Platte River Basin, April to December 1993.* National Water-Quality Assessement (NAWQA) Program, South Platte River Basin Study, USGS (reference available online at http://webserver.cr.usgs.gov).

Land, L. F., J. B. Moring, P. C. Van Metre, D. C. Reutter, B. J. Mahler, A. A. Shipp, and R. L. Ulery. 1998. *Water-quality assessment of the Trinity River Basin, Texas: Pesticides in streams draining an urban and an agricultural area, 1992-95.* U.S. Geological Survey Circular 1171. 37 pages.

Lavalin Environnement. 1988. *Présence des HAP dans l'environnement québécois - Rapport final.* Prepared for Environment Canada, Conservation and Protection. File No. 55526-A3. 56 pages.

Malo, D. and D. Gouin. 1977. *Caractérisation des apports.* Technical Report 14 submitted to the St. Lawrence River Study Committee by the Environmental Protection Services, December 1977.

Mazidji, C. N., B. Koopman, G. Bitton, and G. Voiland. 1990. Use of the Microtox and Ceriodaphnia bioassays in wastewaters fractionation. *Toxicity Assessment* 5: 265–277.

McDonald, J. F. 1988, rev. 1989. *A Review of Pretreatment Programs in the Great Lakes Basin.* Report to the Great Lakes Water Quality Board, by the Municipal Pretreatment Task Force of the Point Source Coordinators, International Joint Commission.

MEF – Ministère de l'Environnement et de la Faune. 1998, rev. 2001 in preparation. *Critères de qualité de l'eau de surface au Québec*. Direction des écosystèmes aquatiques. 375 pages (www.menv.gouv.qc.ca/eau).

MEF – Ministère de l'Environnement et de la Faune. 1996a. *Qualité des eaux du bassin de la rivière des Outaouais, 1979 à 1994*. Direction des écosystèmes aquatiques.

MEF – Ministère de l'Environnement et de la Faune. 1996b. *Analyses des composés organiques en ultra-traces, projet Bilan massique*. Direction des laboratoires. 48 pages.

MEF – Ministère de l'Environnement et de la Faune. 1996c. *Guide d'évaluation et de réduction des toxiques (GÉRT)*. Preliminary version. 62 pages.

MEF – Ministère de l'Environnement et de la Faune. 1995. *Guide de caractérisation des échantillons contaminés par des biphényles polychlorés*. Document décrivant la problématique de l'analyse des BPC au Québec et proposant des éléments de solution. Direction des laboratoires. 59 pages.

MEF – Ministère de l'Environnement et de la Faune. 1991, rev. 1996. *Méthode de calcul des objectifs environnementaux de rejet pour les contaminants du milieu aquatique*. Service d'évaluation des rejets toxiques et Direction de la qualité des cours d'eau. 26 pages.

MEF – Ministère de l'Environnement et de la Faune and Environment Canada. 1998. *Évaluation de la toxicité des effluents des stations d'épuration municipales du Québec – Rapport d'étape*. Saint-Laurent Vision 2000 – Protection Component. 88 pages + appendices.

MEF – Ministère de l'Environnement et de la Faune et Ministère des Affaires municipales (MAM). 1996. *Évaluation de la performance des ouvrages municipaux d'assainissement des eaux du PAEQ – Année 1995*. MEF, Direction des politiques du secteur municipal.

MENV – Ministère de l'Environnement du Québec. 2000. *Bilan annuel de conformité environnementale, secteur des pâtes et papiers 1998*. Direction des politiques du secteur industriel, Service de l'assainissement des eaux. 44 pages + appendices.

MENVIQ – Ministère de l'Environnement du Québec. 1990, rev. 1992. *Méthodologie de calcul de critères de qualité de l'eau pour les substances toxiques*. Service d'évaluation des rejets toxiques, Direction de l'expertise scientifique. 148 pages.

NACEC – North American Commission for Environmental Cooperation. 2000. *Long-range air transport of dioxin from North American sources to ecologically vulnerable receptors in Nunavut, Arctic Canada*. Online references available at www.cec.org. 85 pages + appendices.

Neal, R. A. 1985. Mechanisms of biological effects of PCBs, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in experimental animals. *Environ. Health Perspect*. 60:41-46.

Orr, P. L., G. R. Craig, S. G. Nutt, and J. Stephenson. 1992. *Evaluation of Acute and Chronic Toxicity of Ontario Sewage Treatment Plant Effluents*. Report prepared for MISA, Municipal Section, Ontario Ministry of the Environment. ISBN 0-7729-9401-3.

Painchaud, J. 1997. Tendances de la qualité de l'eau des rivières du Québec, 1979-1994. *Vecteur Environnement* 30(2), April 1997.

Paxéus, N. 1996. "Organic pollutants in the effluents of large wastewater treatment plants". *Sweden. Wat. Res.* 30(5): 1115-1122.

Pham, T. T. 1993. *Caractérisation de l'eau traitée de la station d'épuration de la Communauté urbaine de Montréal*. Conservation and Protection, St. Lawrence Centre, Environment Canada. 39 pages + appendices.

Pham, T. T. and S. Proulx. 1996. *Caractérisation des biphényles polychlorés et des hydrocarbures aromatiques polycycliques dans les eaux de la station d'épuration de la Communauté urbaine de Montréal et dans le panache de son effluent dans le Saint-Laurent*. Environmental Conservation, St. Lawrence Centre, Environment Canada, Quebec Region.

Purdom, C. E., P. A. Hardiman, V. J. Bye, N. C. Eno, C. R. Tyler, and J. P. Sumpter. 1994. Estrogenic effects of effluents from sewage treatment works. *Chem. and Ecol.* 8: 274-285.

Purenne, P. 1998. *Rapport annuel 1997 – Analyse de la qualité des eaux brutes et de l'eau traitée à la station d'épuration et évaluation du rendement des installations*. Communauté urbaine de Montréal, Station d'épuration des eaux usées, Division ingénierie de procédé. 46 pages.

Quémerais, B., C. Lemieux, and K. R. Lum. 1994a. Temporal variation of PCB concentrations in the St. Lawrence River (Canada) and four of its tributaries. *Chemosphere* 28(5): 947-959.

Quémerais, B., C. Lemieux, and K. R. Lum. 1994b. Concentrations and sources of PCBs and organochlorine pesticides in the St. Lawrence River (Canada) and its tributaries. *Chemosphere* 29(3): 591-610.

Quillardet, P., O. Huisman, R. Dari, and M. Hofnung. 1982. SOS Chromotest, a direct assay of induction of SOS function in *Escherichia coli* K-12 to measure genotoxicity. *National Academy of Science* 79: 5971-5975.

Remmers, J., A. Dupuy, D. McDaniel, R. Harless, and D. Steele. 1992. Polychlorinated dibenzo-p-dioxin and dibenzofuran contamination in chloranil and carbazole violet. *Chemosphere* 25(7-10): 1505-1508.

Renner, R. 1997. European bans on surfactant trigger transatlantic debate". *Environmental Science and Technology News* 31(7).

Roberge, S. (1996 to 1999). *Évaluation de la qualité des résultats de caractérisation chimique de l'effluent de la station d'épuration de la municipalité de ... (Québec)*. Environment Canada, Quebec Region, Environmental Conservation, St. Lawrence Centre (series of 30 reports relevant to the 30 physico-chemical characterizations of municipal wastewater treatment plant effluents of the present study).

Rutherford, L. A., Doe, K. G., Wade, S. J., and Hennigar, P. A. 1993. *Aquatic Toxicity and Environmental Impact of Chlorinated Wastewater Effluent Discharges from Four Sewage Treatment Facilities in the Atlantic Region*. 20th Annual Conference on Aquatic Toxicology, Québec.

Samdani, G. and Shanley, A. 1991. "Surfactants: Super Molecules". *Chemical Engineering*, March 1991.

SAS Institute Inc. 1988. *SAS/STAT™ User's Guide*. Release 6.03 Edition.: SAS Institute Inc., Cary, N.C. 1028 pages.

Sekela, M., R. Brewer, G. Moyle, and T. Tuominen. 1999. Occurrence of an environmental estrogen (4-nonylphenol) in sewage treatment plant effluent and the aquatic receiving environment. *Wat. Sci. Tech.* 39(10-11): 217-220.

Servos, M. 1998. "Intersex and Vitellogenin Induction in Fish Reported Downstream of Municipal Effluents in England." *In* Jobling *et al.* (1998). Notes from the National Water Research Institute, Ontario. 3 pages.

Simard, A. and J. Painchaud. 2000. Qualité de l'eau des rivières du Québec, 1988-1998. *Vecteur Environnement* 33(3): 70-74.

SLV-2000 – St. Lawrence Vision 2000. 1995. *Guide général de caractérisation SLV 2000*. SLV 2000, Protection Component.

Stephan C. E., D. I. Mount, D. J. Hansen, J. H. Gentile, G. A. Chapman, and W. A. Brungs. 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*. Office of Water Regulations and Standards, U.S. Environmental Protection Agency, Washington, D.C. 98 pages.

Struger, J., D. Boyter, Z. J. Licsko, and B. D. Johnson. 1994. *Environmental Concentrations of Urban Pesticides*. Environment Canada. 10 pages.

Tétreault, R. P. Bilodeau, B. Daboval, I. Guay, C. Lachapelle, and M. Laurin. 1994. *Programme d'évaluation de la toxicité des effluents des stations d'épuration construites dans le cadre du PAEQ*. Final report, Ministère de l'Environnement et de la Faune du Québec.

Thellen, C., Blaise, C., Roy, Y., and Hickey, C. 1989. Round robin with the *Selenastrum capricornutum* microplate assay. *Hydrobiol.* 188/189: 259-268.

Trudel, L. 1991. *Les dioxines et les furanes dans les sédiments de fond près des 47 usines canadiennes de pâtes et papiers utilisant le procédé de blanchiment au chlore.* Environment Canada, Ecosystem Sciences and Evaluation Directorate, Water Quality Branch, 102 pages + appendices.

UMA Engineering Ltd. 1993. *Municipal Wastewater Treatment Technologies Capable of Achieving Compliance with the Fisheries Act in the Northwest Territories.* Report prepared for Environment Canada. CP(EP) WNR 93-49-1.

U.S. EPA – United States Environmental Protection Agency. 1994. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms.* 3rd ed., Environmental Monitoring Systems Laboratory, USEPA/600/4-89/001. 248 pages.

U.S. EPA – United States Environmental Protection Agency. 1991. *Technical Support Document for Water Quality-Based Toxics Control.* Office of Water, Washington, D.C

U.S. EPA – United States Environmental Protection Agency. 1989. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms.* 2nd ed., USEPA/600/4-89/001. 248 pages.

U.S. EPA – United States Environmental Protection Agency. 1985. *Ambient Water quality Criteria for chlorine – 1984.* U.S. Environmental Protection Agency. EPA 440/5-84-030.

U.S. EPA – United States Environmental Protection Agency. 1981. *Treatability Manual: - Volume II - Industrial Descriptions.* Office of Research and Development, Washington, D.C. 20460.

U.S. GAO – United States General Accounting Office. 1991. *Water Pollution: Nonindustrial Wastewater Pollution Can Be Better Managed.* Report to the Chairman, Committee on Environment and Public Works, U.S. Senate.

Williams, D. T., G. L. LeBel, and F. M. Benoit. 1992. Polychlorodibenzodioxins and polychlorodibenzofurans in dioxazine dyes and pigments. *Chemosphere* 24(2): 169-180.

Woodland Hastings, J., C. J. Potrikus, S. C. Gupta, M. Kurfüst, and J. C. Makemson. 1985. Biochemistry and physiology of bioluminescent bacteria. *Advances in Microb. Physiol.* 26: 235-291.

World Wide Fund for Nature (WWF). 1995. *Les produits toxiques provenant des stations d'épuration des eaux usées. L'oeil de l'aigle. Les Grands Lacs et le fleuve Saint-Laurent.*

Saint-Laurent
Vision 2000

Canada

Québec

TOXIC POTENTIAL ASSESSMENT OF MUNICIPAL WASTEWATER TREATMENT PLANT EFFLUENTS IN QUEBEC

APPENDICES

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APPENDIX 1

BRIEF TECHNICAL DESCRIPTION OF THE WASTEWATER TREATMENT PLANTS SELECTED

Châteauguay

Data on treatment plant

Treatment process : biofiltration (Biofor)
Dephosphatization : yes (alum), in summer only
Design mean streamflow : 27 208 m^3/d
Design mean BOD_5 : 2132 kg/d
Startup date : October 1991
Measured mean streamflow : 131% of design streamflow (1995) (118% in 1994)
Measured mean BOD_5 at intake : 125% of design load (1995) (107% in 1994)
Measured mean BOD_5 at outlet : 9 mg/L (1995); requirement: < 15 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 12 mg/L year-round (1995), not necessarily lower in summer

Industrial Input

Insignificant.

Polluting loads emitted by industrial plants are considered negligible compared to what is generated by the general population. These plants are modest in size and their activities are not likely to generate either great volumes or very polluted effluents.

Communauté urbaine de Montréal (CUM)

Data on treatment plant

Treatment process : physical/chemical
Dephosphatization : yes, year-round (ferric chloride was used during the winter campaign; alum in summer)
Design mean streamflow : 2 786 000 m^3/d
Design mean BOD_5 : 144 000 kg/d
Startup date : March 1988
Measured mean streamflow : 79% of design streamflow (1995) (67% in 1994)
Measured mean BOD_5 at intake : 111% of design load (1995) (99% in 1994)
Measured mean BOD_5 at outlet : 32 mg/L (1995); requirement: none
Measured NH_3-NH_4^+ (N) at outlet : 5 mg/L on ave. in summer and 4 mg/L on ave. in winter (1991 and 1992)

Industrial Input

Significant (proportion unknown).

Three thousand eight hundred (3800) industrial plants were counted in the territory administered by the CUM; roughly 800 of them discharge large quantities of wastewater or effluent likely to contain substances requiring a permit. In early 1997, 540 of these 800 plants had obtained a permit in compliance with Regulation 87 of the CUM, including 200 surface-treatment operations. The CUM estimates that the 800 large establishments release close to 95% of the total volume of industrial wastewater discharged to the city's sewer system.

In a report published in October 1994, the CUM mentioned that, since 1980, its discharges into the St. Lawrence River have decreased by:

- 92% for toxic metals;
- 84% for oils and greases;
- 87% for suspended matter;
- 99% for cyanides.

Given the diversity of industrial plants and the existence of numerous service industries operating in various fields of activity, we can expect to find a great diversity of chemical substances at the intake of the CUM treatment plant. Industrial inputs are thus considered to be substantial, although we cannot determine their exact proportions.

Communauté urbaine de l'Outaouais (CUO)

Data on treatment plant

Treatment process	activated sludge/conventional
Dephosphatization	yes (ferric sulphide), year-round
Design mean streamflow	136 275 m^3/d
Design mean BOD_5	17 580 kg/d
Startup date	September 1984
Measured mean streamflow	104% of design streamflow (1995) (99% in 1994)
Measured mean BOD_5 at intake	104% of design load (1995) (88% in 1994)
Measured mean BOD_5 at outlet	16 mg/L (1995); requirement: < 20 mg/L
Measured NH_3-NH_4^+ (N) at outlet	< 8 mg/L summer and < 13 mg/L winter (1995)

Industrial Input

Insignificant.

There are over 100 industrial plants connected up to the CUO sewer system. Less than ten of them, however, are considered "polluting" by MENV. As most of them pretreat their wastewater, we can consider that the industrial input is insignificant, though not necessarily negligible.

Communauté urbaine de Québec (CUQ) - Eastern Plant

Data on treatment plant

Treatment process : biofiltration (Biodrof)
Dephosphatization : no
Design mean streamflow : 231 000 m^3/d
Design mean BOD_5 : 25 600 kg/d
Startup date : March 1992
Measured mean streamflow : 82% of design streamflow (1995)
Measured mean BOD_5 at intake : 96% of design load (1995)
Measured mean BOD_5 at outlet : 28 mg/L (1995); requirement: < 25 mg/L
Measured NH_3-NH_4^+ (N) at outlet : 10 mg/L ave. in summer and 12 mg/L ave. in winter (1995)

Industrial Input

Proportionally insignificant.

The contaminants most frequently discharged are oils and greases and metals. A few industrial plants release phenols and one plant is losing some mercury.

Cookshire

Data on treatment plant

Treatment process : optional aerated lagoons
Dephosphatization : no
Design mean streamflow : 1552 m^3/d
Design mean BOD_5 : 241 kg/d
Startup date : January 1984
Measured mean streamflow : 100% of design streamflow (1995) (130% in 1994)
Measured mean BOD_5 at intake : 105% of design load (1994) (no data for 1995)
Measured mean BOD_5 at outlet : 16 mg/L (1995); requirement: < 25 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 5 mg/L summer and 9.5 mg/L on ave. in winter (1995)

Industrial Input

Significant (**71% of design BOD_5**).
When this treatment plant was designed, industrial inputs of BOD_5 were estimated at 71%. This industrial-source BOD_5 load was due to the activities of a textile plant that discharged major quantities of oils and greases into the river for many years, two-thirds of which was composed of mineral oils. Between 1993 and 1995, discharges of oils and greases from this plant were reduced by more than 75%. Concentrations of chromium and zinc in the plant's effluent have been well below the standards of the municipal regulation since 1993, and discharges of phenolic compounds have also been reduced considerably.

Farnham

Data on treatment plant

Treatment process : activated sludge/prolonged aeration (oxidation ditch)
Dephosphatization : yes (alum) in summer only
Design mean streamflow : 10 750 m^3/d
Design mean BOD_5 : 1530 kg/d
Startup date : October 1986
Measured mean streamflow : 122% of design streamflow (1995) (128% in 1994)
Measured mean BOD_5 at intake : 77% of design load (1995) (85% in 1994)
Measured mean BOD_5 at outlet : 14 mg/L (1995); requirement: < 20 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 10 mg/L year-round (1995)

Industrial Input

Significant (**82% of design BOD_5**).

When the treatment plant was designed, it was considered that 82% of its BOD_5 load would come from industry — specifically, two textile plants. The main contaminants in the industrial effluents are oils and greases, metals, phenolic compounds and dyes.

Jonquière

Data on treatment plant

Treatment process	:	activated sludge/prolonged aeration (oxidation ditch)
Dephosphatization	:	no
Design mean streamflow	:	42 325 m^3/d
Design mean BOD_5	:	4095 kg/d
Startup date	:	March 1986
Measured mean streamflow	:	102% of design streamflow (1995) (95% in 1994)
Measured mean BOD_5 at intake	:	108% of design load (1995) (108% in 1994)
Measured mean BOD_5 at outlet	:	4 mg/L (1995); requirement: < 20 mg/L
Measured NH_3-NH_4^+ (N) at outlet	:	< 6 mg/L year-round (1996)

Industrial Input

Insignificant (9% of design BOD_5).

When the treatment plant was designed, it was estimated that industrial-source BOD_5 would make up 9% of the total BOD_5 load. The situation has remained relatively unchanged for ten years, and we must consider that input from industry remains insignificant.

La Prairie

Data on treatment plant

Treatment process	activated sludge/prolonged aeration
Dephosphatization	no
Design mean streamflow	65 250 m^3/d
Design mean BOD_5	10 000 kg/d
Startup date	September 1990
Measured mean streamflow	59% of design streamflow (1995) (55% in 1994)
Measured mean BOD_5 at intake	84% of design load (1995) (81% in 1994)
Measured mean BOD_5 at outlet	8 mg/L (1995); requirement: < 20 mg/L
Measured NH_3-NH_4^+ (N) at outlet	< 6 mg/L year-round (1995)

N.B.: These data correspond to wastewater that has undergone all phases of treatment. 32% of the flow at the intake of the treatment plant had been channeled to the outfall after pretreatment due to the inadequate capacity of the sludge treatment unit.

Industrial Input

Significant (**52% of design BOD_5**).

Several large industrial plants, including two agrifood plants and one fine paper mill, release significant loads of organic contaminants. The industrial input currently exceeds estimates made at the time of the plant's design.

Longueuil (Centre d'Épuration Rive-Sud)

Data on treatment plant

Treatment process : physical/chemical
Dephosphatization : yes (alum), year-round
Design mean streamflow : 330 000 m^3/d
Design mean BOD$_5$: 25 100 kg/d
Startup date : September 1992
Measured mean streamflow : 83% of design streamflow (1995) (83% in 1994)
Measured mean BOD$_5$ at intake : 85% of design load (1995) (77% in 1994)
Measured mean BOD$_5$ at outlet : 30 mg/L (1995); requirement: none
Measured NH_3-NH_4^+ (N) at outlet : < 10 mg/L year-round (1993)

Industrial Input

Proportionally insignificant.

A large number of diverse industrial plants discharge their wastewater into the municipal sewer system connected to the Longueuil treatment plant, although the overall load is relatively low. Half of the 25 plants classified by MENV as polluting are surface-treatment operations. They are equipped with pretreatment systems that minimize releases of metals, oils and greases. Agrifood industries, though not numerous, nonetheless contribute the majority of the industrial-source input of BOD$_5$. Overall, industrial effluents represent a small proportion of the streamflow and loading of organic substances channeled to the Longueuil treatment plant. It should be noted, however, that given the number of industries connected up to the wastewater collection system, the impact of industrial discharges may be significant.

Magog

Data on treatment plant

Treatment process : activated sludge/prolonged aeration (oxidation ditch) and tertiary filtration. Continuous addition of chlorine before tertiary filtration.
Dephosphatization : yes (alum), year-round
Design mean streamflow : 15 000 m^3/d
Design mean BOD_5 : 1725 kg/d
Startup date : December 1985
Measured mean streamflow : 107% of design streamflow (1995) (106% in 1994)
Measured mean BOD_5 at intake : 109% of design load (1995) (90% in 1994)
Measured mean BOD_5 at outlet : 3 mg/L (1995); requirement: < 15 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 1 mg/L year-round (1995)

Industrial Input

Significant (**45% of design BOD_5**).

Two meat processing plants discharge their wastewater to the sewer system. One of these plants releases a large load of organic substances (approx. 1250 kg/d after physical/chemical pretreatment) and both establishments discharge heavy loads of total phosphorus. Industrial discharges were initially to represent 45% of the organic load treated at the municipal treatment plant, but this proportion is decidedly higher today. The effluents of both these plants also contain animal oils and greases, chlorine, industrial detergents and nitrites.

Martinville

Data on treatment plant

Treatment process : unaerated lagoons, periodic emptying (spring and fall)
Dephosphatization : yes (alum), only when emptying in spring
Design mean streamflow : 154 m^3/d
Design mean BOD_5 : 14.6 kg/d
Startup date : October 1991
Measured mean streamflow : 108% of design streamflow (1993 to 1995)
Measured mean BOD_5 at intake : 113% of design load (1993 to 1995)
Measured mean BOD_5 at outlet : 12.8 mg/L (1993 to 1995); requirement: none
Measured NH_3-NH_4^+ (N) at outlet : < 6 mg/L year-round (1993 to 1995)

Industrial Input

None.

There are no polluting industrial plants discharging to the sewer system. The only plant in this town operates off-line.

Saint-Gédéon (in Lake Saint-Jean)

Data on treatment plant

Treatment process : optional aerated lagoons
Dephosphatization : no
Design mean streamflow : 791 m^3/d
Design mean BOD_5 : 65 kg/d
Startup date : October 1987
Measured mean streamflow : 106% of design streamflow (1995) (101% in 1994)
Measured mean BOD_5 at intake : 63% of design load (1995) (72% in 1994)
Measured mean BOD_5 at outlet : 15 mg/L (1995); requirement: 30 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 10 mg/L in summer (except once in July 1995 when readings of 11.4 and 13.4 mg/L were obtained; < 11 mg/L in summer 1996) and 12 mg/L on ave. in winter (1995)

Industrial Input

Insignificant.

Industrial-source wastewater is essentially derived from an agrifood establishment that processes and packages vegetables. The industrial input is nonetheless minor.

Saint-Joseph-de-Beauce

Data on treatment plant

Treatment process : optional aerated lagoons
Dephosphatization : yes (alum), in summer only
Design mean streamflow : 5745 m^3/d
Design mean BOD_5 : 653 kg/d
Startup date : August 1988
Measured mean streamflow : 56% of design streamflow (1995) (63% in 1994)
Measured mean BOD_5 at intake : 86% of design load (1995) (85% in 1994)
Measured mean BOD_5 at outlet : 20 mg/L (1995); requirement: 25 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 1 mg/L in summer (July to Sept.) and 32 mg/L on ave. in winter (1995) (24 mg/L winter 1996)

Industrial Input

Significant **(54% of design BOD_5)**.

Industrial effluents derive primarily from an abattoir and meat processing plant. Though it undergoes pretreatment, plant wastewater still contains Kjedahl nitrogen, total phosphorus, chlorines, animal oils and greases, and detergents when released. A second agrifood plant, a small dairy, also discharges polluted wastewater into the municipal sewer system. The wastewaters of other plants in the town are insignificant.

Sawyerville

Data on treatment plant

Treatment process : optional aerated lagoons
Dephosphatization : yes (alum), in summer only
Design mean streamflow : 725 m^3/d
Design mean BOD_5 : 48 kg/d
Startup date : June 1990
Measured mean streamflow : 70% of design streamflow (1995) (89% in 1994)
Measured mean BOD_5 at intake : 69 % of design load (1995) (90% in 1994)
Measured mean BOD_5 at outlet : 6 mg/L (1995); requirement: 25 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 5 mg/L in summer and 11 mg/L on ave. in winter (1995)

Industrial Input

Insignificant.
The industrial activities in this municipality are not considered polluting by MENV. The input of industrial-source pollutants is very minimal.

Warwick

Data on treatment plant

Treatment process : optional aerated lagoons
Dephosphatization : yes (alum) in summer only
Design mean streamflow : 3516 m^3/d
Design mean BOD_5 : 561 kg/d
Startup date : December 1988
Measured mean streamflow : 75% of design streamflow (1995) (74% in 1994)
Measured mean BOD_5 at intake : 123% of design load (1995) (122% in 1994)
Measured mean BOD_5 at outlet : 16 mg/L (1995); requirement: 20 mg/L
Measured NH_3-NH_4^+ (N) at outlet : < 2 mg/L in summer and 13 mg/L on ave. in winter (1995)

Industrial Input

Significant **(70% of design BOD_5)**.

Industrial wastewaters here derive essentially from two agrifood plants, one a potato and corn processing plant, the other a cheese factory. Other plants classified as polluting by MENV are in the textile and cardboard sectors. Since the startup of the treatment plant, the industrial-source load has increased and the capacity of the treatment plant's aeration system has been adjusted accordingly. While the industrial wastewaters may contain phosphates, they should not contain major quantities of toxic substances.

APPENDIX 2

OPERATING CONDITIONS AT THE WASTEWATER TREATMENT PLANTS DURING SAMPLING PERIODS

OPERATING CONDITIONS OF TREATMENT PLANTS DURING SAMPLING PERIODS

The following two tables summarize the operating conditions reported at the treatment plants during the winter and summer sampling periods, respectively. The case of Martinville is not shown because of its distinctive method of operation (periodic filling and emptying of unaerated lagoons). The spring and fall emptyings were performed as usual at this treatment plant and the analytical results appear normal for this type of process.

With a few exceptions, measured streamflows are relatively weak as they were obtained during dry periods. Streamflow measurements taken in summer operating conditions are generally a little higher than those obtained in winter operating conditions. All mean streamflow rates conform to normal plant operating conditions, except in the case of Saint-Gédéon and Sawyerville, whose rates are noticeably lower than the annual means in 1994 and 1995. Further, although streamflow rates at some other plants exceeded design streamflows, they also represent normal operating conditions as they are comparable to plant monitoring data.

There were few rainfall episodes during the sampling periods. Only the following sampling work was performed during a rainfall:

- Châteauguay: January 22–23, 1997 (7.6 mm of rain and 1.2 cm of melting snow)
- CUO: July 5–6, 1999 (14.5 mm of rain) and July 9–10, 1999 (15.5 mm of rain)
- CUQ: July 5–6, 1999 (9.6 mm of rain) and July 7–8, 1999 (8.4 mm of rain)
- Jonquière: September 18–19, 1998 (13 mm of rain).

The only overflow or bypass episodes during the winter sampling periods occurred at the La Prairie and Longueuil treatment plants. In La Prairie, part of the streamflow was continually bypassed because of the inadequacy of the sludge treatment process. As for Longueuil, only a few overflow episodes took place before or after pretreatment. During the summer sampling activities, overflows were reported at the plants of the CUO (July 9–10, 1999), the CUQ (July 7–8, 1999) and Jonquière (September 18–19, 1998). These overflows lasted for 2 to 3 hours and were caused by rain. In all these cases, samples were drawn in water that had undergone all phases of treatment.

Despite some elevated concentrations of BOD_5 and SM, there is no reason to believe that the treatment plants sampled do a poor job. Indeed, the sometimes very high concentrations of BOD_5 obtained by the firm Sodexen in winter (Chateauguay, CUM, CUO, Farnham, La Prairie, Longueuil and Magog) had to be rejected because of the contamination of sampling receptacles (see Chapter 3 of the report). Doubts were also raised about some concentrations of SM as they do not coincide with the high values of other parameters like P_t or with the monitoring results obtained at the plant.

Operating Conditions during the Winter Sampling Periods

Stations *	Dates	Débits (m^3/d) (% du débit de conception)	Dérivation ou débordement	Concentration inférieure à l'exigence périodique **		
				DBO$_5$	MES	P$_t$
Châteauguay	20/21 jan'97	18 633 (68%)	non	(1)	oui	Aucune exigence l'hiver
	22/23 jan'97	34 345 (126%)	non	(1)	oui	
	24/25 jan'97	23 571 (87%)	non	(1)	oui	
CUM	9/10 déc'96	2 478 780 (92%)	non	Aucune exigence	oui	(11)
	11/12 déc'96	2 413 440 (89%)	non		oui	(11)
	13/14 déc'96	2 753 280 (102%)	non		non (58 mg/L) (2)	(11)
CUO	6/7 jan'97	150 555 (110%)	non	(1)	non (59 mg/L)	(11)
	8/9 jan'97	128 023 (94%)	non	(1)	non (167 mg/L)	(11)
	10/11 jan'97	124 747 (92%)	non	(1)	non (89 mg/L) (3)	(11)
CUQ (station Est)	5/6 jan'97	161 274 (70%)	non	oui	oui	Aucune exigence
	7/8 jan'97	151 234 (65%)	non	oui	oui	
	9/10 jan'97	158 989 (69%)	non	non (44 mg/L)	oui	
Cookshire	3 jan'97	1 213 (78%)	non	oui	Aucune exigence	Aucune exigence
	5 jan'97	1 278 (82%)	non	oui		
	7 jan'97	1 256 (81%)	non	non (35 mg/L)		
Farnham	10/11 fév'97	12 914 (120%)	non	(1)	oui	(11)
	12/13 fév'97	12 750 (119%)	non	(1)	oui	(11)
	14/15 fév'97	13 099 (122%)	non	(1)	oui	(11)
Jonquière	19/20 jan'97	35 854 (85%)	non	oui	oui	Aucune exigence
	21/22 jan'97	33 967 (80%)	non	oui	oui	
	23/24 jan'97	34 277 (81%)	non	oui	oui	
La Prairie	2/3 déc'96	50 333 (77%)	oui (4)	(1)	oui	Aucune exigence
	4/5 déc'96	48 990 (74%)	oui (4)	(1)	oui	
	6/7 déc'96	45 356 (69%)	oui (4)	(1)	non (112 mg/L)	
Longueuil	9/10 déc'96	321 000 (97%)	oui (5)	Aucune exigence	oui	(11)
	11/12 déc'96	296 000 (90%)	non		oui	(11)
	13/14 déc'96	324 000 (98%)	oui (5)		non (57 mg/L) (6)	(11)
Magog	13/14 jan'97	12 868 (86%)	non	(1)	oui	(11)
	15/16 jan'97	12 595 (84%)	non	(1)	oui	(11)
	17/18 jan'97	12 052 (80%)	non	(1)	oui	(11)
Saint-Gédéon	20 jan'97	478 (60%)	non	oui	Aucune exigence	Aucune exigence
	22 jan'97	460 (58%)	non	oui		
	24 jan'97	426 (54%)	non	oui		
Saint-Joseph-de-Beauce	27 jan'97	3 725 (65%)	non	oui	Aucune exigence	Aucune exigence l'hiver
	29 jan'97	3 364 (59%)	non	oui		
	31 jan'97	3 024 (53%)	non	oui		
Sawyerville	3 fév'97	332 (46%)	non	oui	Aucune exigence	Aucune exigence l'hiver
	5 fév'97	377 (52%)	non	oui		
	7 fév'97	290 (40%)	non	oui		
Warwick	27 jan'97	2 732 (78%)	non	non (22 mg/L)	Aucune exigence	Aucune exigence l'hiver
	29 jan'97	2 513 (71%)	non	oui		
	31 jan'97	2 405 (68%)	non	oui		

See legend on page 24.

OPERATING CONDITIONS DURING THE SUMMER SAMPLING PERIODS

STATIONS *	DATES	DÉBITS (m^3/d) (% du débit de conception)	DÉRIVATION OU DÉBORDEMENT	CONCENTRATION INFÉRIEURE À L'EXIGENCE PÉRIODIQUE **		
				DBO_5	MES	P_t
Châteauguay	14/15 juin'99	37 915 (139%)	non	oui	oui	oui
	16/17 juin'99	33 855 (124%)	non	oui	oui	oui
	18/19 juin'99	34 750 (128%)	non	oui	oui	oui
CUM	28/29 sept'98	2 273 000 (82%)	non	Aucune exigence	oui	oui
	30 sep/1 oct'98	2 581 000 (93%)	non		oui	oui
	2/3 oct'98	2 194 000 (78%)	non		oui	oui
	7/8 juin'99	2 228 667 (80%)	non		oui	oui
	9/10 juin'99	2 265 000 (81%)	non		oui	oui
	11/12 juin'99	2 199 667 (79%)	non		oui	oui
CUO	5/6 juil'99	152 915 (112%)	non	oui	oui	oui
	7/8 juil'99	136 133 (100%)	non	oui	oui	oui
	9/10 juil'99	158 366 (116%)	oui (7)	oui	oui	oui
CUQ (station Est)	5/6 juil'99	178 705 (77%)	non	oui	oui	Aucune exigence
	7/8 juil'99	230 307 (100%)	oui (8)	oui	oui	
	9/10 juil'99	181 372 (79%)	non	oui	oui	
Cookshire	13 juil'99	1 978 (127%)	non	oui	Aucune exigence	Aucune exigence
	15 juil'99	1 928 (124%)	non	oui		
	17 juil'99	1 953 (126%)	non	oui		
Farnham	12/13 juil'99	14 737 (137%)	non	oui	oui	oui
	14/15 juil'99	15 081 (140%)	non	oui	oui	oui
	16/17 juil'99	11 940 (111%)	non	oui	oui	oui
Jonquière	14/15 sept'98	37 906 (90%)	non	oui	oui	Aucune exigence
	16/17 sept'98	46 256 (109%)	non	oui	oui	
	18/19 sept'98	47 543 (112%)	oui (9)	oui	oui	
La Prairie	14/15 juin'99	48 474 (74%)	(10)	oui	oui	Aucune exigence
	16/17 juin'99	44 209 (68%)	(10)	oui	oui	
	18/19 juin'99	45 690 (70%)	(10)	oui	oui	
Longueuil	28/29 sept'98	247 000 (75%)	non	Aucune exigence	Non (48 mg/L)	non (1,05 mg/L)
	30 sep/1 oct'98	280 000 (85%)	non		oui	non (0,85 mg/L)
	2/3 oct'98	250 667 (76%)	non		oui	oui
	7/8 juin'99	255 333 (77%)	non		oui	oui
	9/10 juin'99	239 667 (73%)	non		oui	oui
	11/12 juin'99	242 333 (73%)	non		oui	oui
Saint-Gédéon	15 sept'98	479 (61%)	(10)	oui	Aucune exigence	Aucune exigence
	17 sept'98	479 (61%)	(10)	oui		
	19 sept'98	659 (83%)	(10)	oui		
Saint-Joseph-de-Beauce	21 sept'98	2 823 (49%)	(10)	oui	Aucune exigence	oui
	23 sept'98	4 822 (84%)	(10)	oui		oui
	25 sept'98	3 867 (67%)	(10)	oui		oui
Sawyerville	23 sept'96	290 (40%)	non	oui	Aucune exigence	oui
	25 sept'96	290 (40%)	non	oui		oui
	27 sept'96	216 (30%)	non	oui		oui

See legend on page 24.

LEGEND FOR TABLES ON OPERATING CONDITIONS DURING SAMPLING

*: Except Martinville, which is not shown because of its distinctive operating method (periodic filling and emptying of unaerated lagoons).

** : The periodic requirement applies to the mean of the results obtained over a trimester, a month or a week, depending on the plant. What is presented here, therefore, should not be taken as verification that the plant respects discharge requirements.

(1) : Values obtained for BOD_5 must be rejected due to a handling error. Based on the results for SM and P_t as well as results provided by plant operators (Magog and Farnham), there is no reason to believe that these plants malfunctioned during the sampling periods.

(2) : The value of 58 mg/L is questionable as the CUM obtained 24 mg/L on December 13, and 22 mg/L on December 14 during routine monitoring.

(3) : The SM values obtained by the firm Sodexen are very surprising, especially considering that we obtained values below 0.3 mg/L of P_t. Elevated concentrations of iron (2.7, 3.8 and 3.3 mg/L) indicate the possible loss of sludges to the effluent.

(4) : There were continual bypasses of part of the streamflow at this plant due to the inadequacy of the sludge treatment process. The analysis was performed on that part of the water that had undergone all phases of treatment.

(5) : Episodic overflows of part of the streamflow before or after pretreatment.

(6) : The SM value obtained by the firm Sodexen is surprising, given that the sample only showed a P_t concentration of 0.31mg/L and that 15 mg/L of SM was recorded during routine monitoring.

(7) : Overflow for two hours on July 9 caused by heavy rainfall.

(8) : Overflow upstream of the plant for three hours during sampling.

(9) : Overflow for 2 hours and 24 minutes at the end of the sampling period.

(10) : No overflows or bypasses were recorded during sampling.

APPENDIX 3

RESULTS OF *IN SITU* MEASUREMENTS OF pH, TEMPERATURE, DISSOLVED OXYGEN AND TOTAL RESIDUAL CHLORINE AT THE WASTEWATER TREATMENT PLANTS DURING SAMPLING

RESULTS OF *IN SITU* MEASUREMENTS

WINTER SAMPLING

Stations d'épuration	pH (1)			Température (2) (° C)			Oxygène dissous (1) (mg/L)		
	Jour 1	**Jour 3**	**Jour 5**	**Jour 1**	**Jour 3**	**Jour 5**	**Jour 1**	**Jour 3**	**Jour 5**
Châteauguay 97	7,4-7,7	7,2-7,7	7,4-7,6	6,3-8,3	6,5-8,5	7,5-8,6	11,4	8,4	7,2
CUM 96	6,7-7,2	6,9-7,1	7,1-7,2	14,1 (moy.)	12,3-13,4	10,9-12,1	8,3	7,4	6,4
CUO 97	6,9-7,1	6,9-7,1	7,1-7,1	9,1-9,4	12,1-12,8	12,6-12,6	5,1	3,8	3,6
CUQ – st. Est 97	7,2	7,2	7,2	11-12	10,5-11,5	10-11	8,2	8,2	7,6
Cookshire 97	7,1	7,2	7,1	0	0	0	8,8	8,2	9,6
Farnham 97	6,1-7,2	6,6-7,2	6,7-6,8	6,3-8,1	7,2-10,3	8,1-9,8	3,2	3,2	3,0
Jonquière 97	7,1	6,9	7,0	8,5-9,0	8,5-9,0	8,0-8,5	7,9	7,8	7,8
La Prairie 96	nv	7,1-7,1	7,0-7,0	nv	16,0-16,5	12,4-12,6	8,9	8,4	8,0
Longueuil 96	6,8-7,5	7,1-7,3	7,2-8,5	10,0-13,6	10,2-11,2	9,8-10,9	8,4	8,8	9,0
Magog 97	6,8-6,9	6,9-7,0	6,5-7,2	6,5-7,1	7,4-7,8	4,8-8,6	7,8	8,2	10,1
Martinville 99	7,3	7,4	7,4	15	15	16	6,3	7,1	6,4
Saint-Gédéon 97	7,4	7,4	7,4	0	0	0	7,4	7,8	7,7
Saint-Joseph-de-Beauce 97	7,4	7,4	7,4	0	0	0	10,6	12,0	12,4
Sawyerville 97	7,2	7,3	7,3	0	0	0	10,0	9,9	10,8
Warwick 97	7,5	7,5	7,5	0	0	0	11,5	11,5	12,1

(1) : Les mesures de pH et d'oxygène dissous ont été effectuées sur l'échantillon prélevé, sauf en ce qui concerne le pH des stations suivantes qui ont été effectuées directement sur l'effluent de la station : Châteauguay, CUM, CUO, Farnham, La Prairie, Longueuil et Magog (on y présente alors les valeurs minimums et maximums mesurées durant la période d'échantillonnage).

(2) : Mesures effectuées directement sur l'effluent de la station. On y présente les valeurs minimums et maximums mesurées durant la période d'échantillonnage ou une valeur unique dans le cas des échantillonnages instantanés.

nv : Mesures non valides.

Station d'épuration	Chlore résiduel total (mg/L)		
	Jour 1	**Jour 3**	**Jour 5**
Magog 97	< 0,10	< 0,10	< 0,10

RESULTS OF *IN SITU* MEASUREMENTS

SUMMER SAMPLING

Stations d'épuration	pH (1)			Température (2) (° C)			Oxygène dissous (1) (mg/L)		
	Jour 1	Jour 3	Jour 5	Jour 1	Jour 3	Jour 5	Jour 1	Jour 3	Jour 5
Châteauguay 99	7,1-7,3	7,1-7,3	7,1-7,2	16,6-17,3	16,3-17,1	16,5-17,4	5,1	5,2	5,0
CUM 98	7,2-7,4	7,1-7,4	6,9-7,4	21,2-21,7	20,9-22,1	20,6-21,0	3,5	3,0	3,2
CUM 99	6,8-7,2	7,0-7,3	6,7-7,2	19,7-21,2	20,7-21,5	20,9-21,8	2,7	2,9	2,8
CUO 99	7,2-7,4	7,3-7,6	7,5-7,6	22,2-23,2	21,1-22,5	20,7-21,4	6,3	6,5	6,4
CUQ – st. Est 99	7,1-7,5	7,0-7,7	7,1-7,5	19,1-20,6	17,6-20,4	18,7-21,5	6,2	6,4	5,7
Cookshire 99	7,0	7,3	7,1	18	21	22	2,7	2,6	1,8
Farnham 99	7,3-7,5	7,3-7,4	7,0-7,3	20,2-21,8	21,3-22,5	23,5-24,4	4,3	3,7	3,9
Jonquière 98	6,9-7,5	6,9-7,6	7,0-7,4	14,4-18,9	16,5-17,9	16,9-17,5	6,6	7,0	7,2
La Prairie 99	6,7-7,6	7,3-7,8	7,3-7,9	21,0-23,0	19,6-20,6	20,4-21,6	2,5	2,3	2,0
Longueuil 98	6,8-7,1	6,7-7,0	6,5-6,8	20,1-20,8	17,7-20,8	19,3-19,9	6,2	6,4	6,2
Longueuil 99	6,8-7,1	6,8-7,0	6,7-6,9	17,1-18,5	17,9-18,4	18,0-19,7	5,8	5,9	6,0
Martinville 96 (3)	8,8	8 8,3	8,5	9	10 6	5	9,6	8,7 11,2	11,2
Saint-Gédéon 98	7,0	6,8	6,7	17	16	15	5,1	4,2	5,1
Saint-Joseph-de-Beauce 98	6,0	6,9	5,9	18	16	15,2	9,9	7,9	8,2
Sawyerville 96	7,4	7,4	7,4	16,5	16	15	4,7	5,5	5,1

(1) : Les mesures de pH et d'oxygène dissous ont été effectuées sur l'échantillon prélevé, sauf en ce qui concerne le pH des stations suivantes qui ont été effectuées directement sur l'effluent de la station : Châteauguay, CUM, CUO, CUQ (station Est), Farnham, Jonquière, La Prairie et Longueuil (on y présente alors les valeurs minimums et maximums mesurées durant la période d'échantillonnage).

(2) : Mesures effectuées directement sur l'effluent de la station. On y présente les valeurs minimums et maximums mesurées durant la période d'échantillonnage ou une valeur unique dans le cas des échantillonnages instantanés.

(3) : Station échantillonnée quatre jours différents.

APPENDIX 4

METHODS AND TEST CONDITIONS FOR THE TOXICITY TESTS

TOXICITY TEST METHODS AND CONDITIONS

An assay was conducted on the marine bacterium *Vibrio fischeri* (Microtox^{TM}) using the protocol of Environment Canada (1992a), with certain modifications, as described in standard operating procedure LB-MIL-931007-1 (Environment Canada, 1995). This toxicity test is based on the capacity of *V. fischeri* to emit light, a metabolic process involving a series of enzymes (Woodland Hastings et al., 1985). The light intensity of the test groups and the control is measured with a photometer (Microtox™ Toxicity Analyzer, model M500).

The SOS Chromotest was performed according to a protocol developed by the laboratory of the St. Lawrence Centre (Environment Canada, 1993). The SOS Chromotest can detect the presence of substances that cause primary lesions to the DNA of *Escherichia coli* PQ37 (Quillardet et al., 1982). When bacterial DNA is attacked by a genotoxic chemical, synthesis of the enzyme ß-gal is activated in the bacterium. Moreover, analysis of alkaline phosphatase (ALP) makes it possible to determine the degree of toxicity or the loss of cell viability. The tests were conducted both with and without a mammalian activating enivronment (S9) in order to detect the so-called progenotoxic substances — that is, those molecules that, once metabolized, have the potential to damage genetic material. Relative concentrations of ß-gal and ALP are measured after the addition of their respective substrates. Relative concentrations of ALP (yellow) and ß-gal (blue) are read with a microplate spectrophotometer (Multiskan™, model MCC340) at 405 nm (A405) and 620 nm (A620), respectively. The reduction factors (RF) of ALP, the induction factors (IF) of ß-gal, as well as the induction factors corrected for viability (IFCV) are then determined and compared to those of the control groups. These factors are used to calculate the lowest observed effect (LOEC) and the no-observed effect concentration (NOEC). Depending on the effect variable, the measurement parameters are expressed in chronic sublethal toxic (TU_{CS}) or genotoxic (GU_{CS}) units.

The algal toxicity test was performed in 96-well microplates according to the method developed by Environment Canada (1992b). The test consists of exposing a culture of *Selenastrum capricornutum* to a geometric series of dilutions (e.g. 100, 50, 25, 12.5 and 6.3%, v/v) of effluent for 72 h, then measuring the concentration of algae (number of cells per millilitre) with a particle counter (Coulter, model ZM). The number of algae cells in the effluent dilutions are then compared to the number recorded in the controls. Growth inhibition percentages are first determined, after which IC_{50}, NOEC and LOEC are calculated.

The toxicity test on the microcrustacean *Ceriodaphnia dubia* indicates both the severity of the lethal (survival) and chronic sublethal (reproduction) effects; the experimental approach of Environment Canada (1992c) was applied here. Briefly, the test consists of exposing ten young (newborn) crustaceans to a geometric series of dilutions of effluent for seven days. Both the newborns produced and the dead organisms are counted daily. The effects on survival are quantified by LC_{50}, NOEC and LOEC; on reproduction, by IC_{50}, NOEC and LOEC. The results are reported in lethal toxicity units (TU_L) for survival and in sublethal toxicity units (TU_{CS}) for reproduction.

As with *C. dubia*, *Daphnia magna* belongs to the order Cladocera and family Daphnidae. This static toxicity test focuses on newborns (24-hours-old maximum) and indicates the severity of the lethal effects (survival). It was conducted according to the standard methods of Environment Canada (1990a; 1990b). Briefly, ten organisms are exposed to a geometric series of effluent dilutions and daphnia deaths are recorded after 48 h of exposure. Effects on survival are quantified by LC_{50}. The results are reported in lethal toxicity units (TU_L).

The fathead minnow (*Pimephales promelas)* larval growth and survival test was conducted according to the protocol of Environment Canada (1992d). Briefly, ten larvae of more than 24-hours-old were exposed to a geometric series of effluent dilutions for seven days. Mortalities are recorded at 24-h intervals throughout the assay. At the end of the seven-day exposure period, the surviving fish are counted and dried, and then mean dry weight per fish is determined. The effects on survival are quantified by LC_{50}, NOEC and LOEC; effects on growth by IC_{50}, NOEC and LOEC. The results are reported in lethal toxicity units (TU_L) for survival, and in acute sublethal toxicity units (TU_{AS}) (or chronic, depending on MENV's assessment) for growth.

The acute lethality test on rainbow trout (*Oncorhynchus mykiss*) was conducted according to the standard methods of Environment Canada (1990c; 1990d). The procedure consists of exposing ten fish to geometric concentrations of effluent for a 96-hour period. Mortalities are noted daily and the number of dead fish per concentration tested is used to calculate the LC_{50}. The results are reported in lethal toxicity units (TU_L).

The table on the following page summarizes the conditions under which the toxicity tests were performed.

Main Test Conditions used for the Toxicity Tests

CONDITIONS D'ESSAI	*V. fischeri*	*E. coli PQ37*	*S. capricornutum*	*C. dubia*	*D. magna*	*P. promelas*	*O. mykiss*
Méthodes	Statique	Statique	Statique	Statique ou Renouvellement quotidien	Statique	Statique ou Renouvellement quotidien	Statique
Durée	15 min	2 h	3 d	7 d	48 h	7 j	96 h
Température (°C)	15 ± 0,3	37 ± 1	24 ± 2	25 ± 1	20 ± 2	25 ± 1	15 ± 1
Types de récipient	Cuvettes de verre 12 × 50 mm	Microplaques 96 puits	Microplaques 96 puits	Gobelets de 30 mL	Tubes de verre 200 x 25 mm	Aquariums de verre	Seaux de 60 L
Volume par récipient d'essai	1 mL	200 µL	200 µL	15 mL	60 mL	500 mL	60 L
Photopériode lumière/obscurité (h)	s.o.	s.o.	24/0	16/8	16/8	16/8	16/8
Nombre de concentrations testées	6	7	10	6	6	6	5
Nombre de répétitions par concentration	4	4	3	10	3	4	1
Nombre d'organismes par récipient d'essai	1×10^6	3×10^6	10 000	1	20	10	10

s.o. = sans objet.

APPENDIX 5

THE POTENTIAL ECOTOXIC EFFECTS PROBE (PEEP)

THE POTENTIAL ECOTOXIC EFFECTS PROBE:
PEEP

An index for comparing the potential toxicity of industrial effluents

The Potential Ecotoxic Effects Probe (PEEP) is an index that combines the results of biological tests (bioassays) representing several trophic levels in the aquatic environment and several types of toxicity (acute lethality, acute and/or chronic sublethality, and genotoxicity). It can be used to evaluate and compare the toxic potential of industrial effluents since it takes into account:

1. ***the toxicity results of the different bioassays;***

2. ***the persistence of the toxicity (the tests are repeated on an effluent sample after it has undergone biodegradation for a five-day period);***

3. ***the (multi)specificity of the toxic impact (number of aquatic species affected by the effluent);***

4. ***the flow rate of the effluent (m^3/h) which can be used to estimate the toxic load.***

All of these elements are expressed as a single value on a logarithmic scale ($\log_{10}$) ranging from 0 to 10.

The mathematical structure of the index is flexible enough that bioassays can be added or removed as needed.

KEY POINTS

- Easy to use and interpret;
- High discrimination power;
- Cost-effective tool for evaluating the potential impact of liquid toxic discharges;
- Index that takes account of bioavailability and possible interactions among toxic substances (additive, antagonistic and synergistic effects);
- Essential complement to physico-chemical characterization for ensuring optimal management of industrial effluents.

CURRENT APPLICATIONS

- Evaluating the potential toxicity of industrial and municipal effluents;
- Managing effluent toxicity within an industrial plant;
- Assessing the effectiveness of toxicity abatement measures for effluents;
- Selecting standard bioanalytical levels for screening liquid toxic discharges.

FUTURE APPLICATION

- Evaluating the toxic potential of solid matrices (sludges, soils or contaminated sediments).

ISSUES

Chemical analyses, despite their usefulness, cannot be used to assess the potential toxicity of complex mixtures such as industrial effluents.

Although bioassays can be employed to evaluate the bioavailability of the toxic substances present in complex mixtures, and hence their toxic potential, the lack of standardization in the way toxicity results are reported makes interpretation difficult.

The impact of a toxic effluent may vary according to the concentration, quantity, persistence and fate of the toxic substances it contains.

SOLUTION

PEEP is a single index that integrates the results of bioassays performed with different organisms and different toxic effect criteria. The toxic effects cover all potential antagonistic, additive and synergistic interactions.

All of the results are calculated based on effect thresholds and reported in toxic units. This strategy, coupled with assessment of the persistence of the toxicity and the effluent flow rate (used to compute the toxic load), represents the first attempt to group various ecotoxicological concepts in a simple, practical and useful work tool.

All of the toxic responses (10) are integrated in a mathematical formula to obtain a value on a logarithmic scale ($\log_{10}$).

Expressing the results as a single value makes it possible to quickly and accurately identify effluents that show the maximum level of toxicity. An index value of this type is also more easily disseminated to the general public, which is accustomed to receiving synthesized information. In this respect, it can be likened to the Richter scale, which measures seismic activity.

The PEEP index has a high discrimination power and a flexible structure that allows bioassays to eventually be added or removed. This flexibility permits some generalization of results (comparisons can be made between the results obtained from a different number of bioassays), while also keeping the index in the forefront of technology.

In addition, the PEEP scale provides a ready means of estimating the relative toxicity of a given effluent, that is, its percentage-wise contribution to the toxicity of a group of effluents considered as a whole.

PRINCIPLES

Measurement of toxic effects

Six toxic effect criteria, including mortality, growth inhibition and reproductive inhibition, are evaluated by means of five bioassays that use organisms (bacteria, algae, crustaceans) representing different trophic levels: decomposers, primary producers and consumers. Several levels and types of toxicity are analyzed: lethal, acute sublethal, chronic sublethal and genotoxicity.

The bioassays were selected based on various criteria: sensitivity, cost, rapid response, degree of standardization, etc.

Some of the bioassays are repeated following biodegradation of the effluent sample (simulation of secondary treatment in an aerated lagoon over a five-day period) in order to measure any changes in toxicity resulting from microbiological activity.

Calculation of the PEEP index value

The elements considered (number of bioassays, persistence of toxicity, effluent flow rate) are integrated into the following formula:

$$\log_{10}[1+n(\frac{\sum_{i=1}^{k} Av+Ap}{N})\times D]$$

where

n: number of bioassays exhibiting toxic responses;
k: number of bioassays used;
N: maximum number of possible toxic responses;
Av: result of a particular bioassay before biodegradation of the sample;
Ap: result of a particular bioassay after biodegradation of the sample;
D: effluent flow rate (m^3/h).
The coefficient *n* indicates the extent of the toxicity, that is, the (multi)specificity of the toxic impact.

Responses revealing toxicity are identified by measuring the toxic threshold, that is, the geometric mean of the no observable effect concentration [NOEC] and the lowest observable effect concentration [LOEC]. They are expressed in toxic units (TU = 100/toxic threshold in % v/v [effluent volume over total volume tested]. The mean of the responses ($[\Sigma\, Av + Ap]/N$) indicates the toxic strength, that is, the expression in effect units of the concentration of bioavailable toxic substances.
The coefficient *n* multiplied by the toxic strength identifies an effluent's "toxic print," which reflects the relative strength and extent of the toxicity.

The product of the toxic print and the flow rate yields the "toxic load" (TU/hour), which can be used to determine the relative contribution of a given effluent to the overall toxicity of a group of effluents.

The $\log_{10}$ of the toxic load + 1 yields the final PEEP value.

In theory, the PEEP scale covers a range from 0 to infinity. In practice, however, PEEP values rarely exceed 8, owing to logarithmic progression. A value of 7 and over indicates a very high toxic potential. A decrease on the PEEP scale from 6 to 5 corresponds to a 90% reduction in the potential toxic load of an effluent.

LIMITATIONS

The PEEP index evaluates only the toxicity of industrial effluents. It does not take account of bioaccumulation processes or the buffering capacity of the receiving environment. Furthermore, the index primarily measures the toxicity of dissolved substances in the water and not that associated with suspended solids.

The flow rate value determines the detection limit of the index. To determine this limit, it is assumed that only one of the ten toxic responses occurs at an intensity of 1 TU. Hence, the toxic print would be 0.1 TU and the toxic load 0.1 times the flow rate. For example, if a single bioassay yielded 1 TU for a sample of effluent with a flow rate of 1000 m^3/h, the toxic load would be 100 TU/h and the PEEP 2, which corresponds to the minimum detectable limit.

APPLICATIONS

St. Lawrence Action Plan (SLAP)

The main objective of SLAP (1988 to 1993) was to reduce by 90% the toxic effluents discharged by the 50 targeted priority plants. To reach this objective, it was necessary to identify the major sources of pollution and apply toxicity abatement measures to those discharges identified as being the most problematic. The PEEP index was thus used to characterize and rank all the industrial plants covered by SLAP based on their effluents' toxic load.

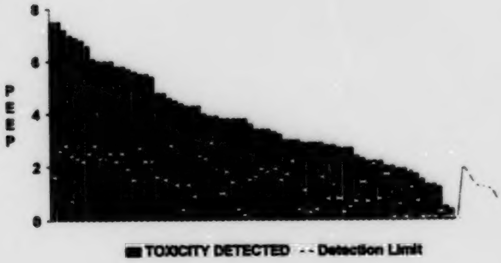
St. Lawrence Vision 2000 (SLV 2000)

The long-term objective of the Protection component of SLV 2000 (1993 to 1998) is to reduce liquid toxic discharges and virtually eliminate discharges of persistent toxic substances.

To achieve this objective, the activities of the Protection component are directed primarily at 106 priority industrial plants, and seek to reduce their discharges of toxic effluents. PEEP values are computed for these effluents in order to assess the potential toxicity of the discharges; they are used as a complement to physico-chemical characterizations in setting priorities for pollution control measures.

Figure 1 shows the toxicity levels detected to date in 77 industrial effluents. It can be seen that the PEEP index has sufficient sensitivity to evaluate and quantify the toxic load of most industrial effluents.

FIGURE 1 - PEEP VALUES
FOR 77 INDUSTRIAL EFFLUENTS



The Environmental Choice Program

The goal of this program is to encourage manufacturers and importers of various products to exercise their right to use the EcoLogo symbol on their packaging, showing that the products have a limited environmental impact. Before EcoLogo can be used to identify a particular product or its ingredients, certain ecotoxicological criteria must be met. For all-purpose cleaning products, the PEEP index was used in defining the standard bioanalytical levels to be applied in evaluating the whole product for *aquatic toxicity*.

INFORMATION

For more information on the PEEP index, please contact:
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APPENDIX 6

RESULTS OF TOXICITY TESTS

Winter sampling: pages 45 to 59
Summer sampling: pages 60 to 74

CHÂTEAUGUAY – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				4,0	4,0
		CSEO				8,0	8,0
		CSE				5,7	5,7
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		1,0			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,8			
	UT_{SA}	CI_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
O. mykiss[1]	UT_L	CL_{50}	nv	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUM – HIVER 1996

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicités	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				2,0	< 2,0
		CSEO				4,0	2,0
		CSE				2,8	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				4,0	2,0
		CSEO				8,0	4,0
		CSE				5,7	2,8
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				2,0	2,0
		CSEO				4,0	4,0
		CSE				2,8	2,8
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			1,1	< 1,0
		CSEO	1,0			2,2	1,0
		CSE	< 1,0			1,6	< 1,0
C. dubia Survie	UT_{L}	CL_{50}		1,4		< 1,0	
		CMEO		1,0		< 1,0	
		CSEO		2,0		1,0	
		CSE		1,4		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		2,0		2,0	
		CSEO		4,0		4,0	
		CSE		2,8		2,8	
D. magna[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_{L}	CL_{50}		< 1,0			
		CMEO		11,1			
		CSEO		100,0			
		CSE		33,3			
	UT_{SA}	CI_{50}		4,8			
		CMEO		100,0			
		CSEO		> 100,0			
		CSE		> 100,0			
O. mykiss[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque **- Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.**

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUO – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				4,0	< 2,0
		CSEO				8,0	2,0
		CSE				5,7	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		1,3			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		< 1,0			
		CMEO		4,0			
		CSEO		8,0			
		CSE		5,7			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	nv	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUQ (STATION EST) – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9)	UG$_{SC}$	CMEO				8,0	4,0
Génotoxicité		CSEO				16,0	8,0
		CSE				11,3	5,7
E. coli PQ37 (+ S9)	UG$_{SC}$	CMEO				4,0	< 2,0
Génotoxicité		CSEO				8,0	2,0
		CSE				5,7	< 2,0
E. coli PQ37 (- S9)	UT$_{SC}$	CMEO				< 2,0	< 2,0
Toxicité [1]		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9)	UT$_{SC}$	CMEO				< 2,0	< 2,0
Toxicité [1]		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT$_{SC}$	CI$_{50}$	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia	UT$_{L}$	CL$_{50}$		< 1,0		< 1,0	
Survie		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia	UT$_{SC}$	CMEO		1,0		< 1,0	
Reproduction		CSEO		2,0		1,0	
		CSE		1,4		< 1,0	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT$_{L}$	CL$_{50}$		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
	UT$_{SA}$	CI$_{50}$		< 1,0			
		CMEO		16,7			
		CSEO		> 16,7			
		CSE		> 16,7			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	< 1,0	1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

COOKSHIRE – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				8,0	8,0
		CSEO				16,0	16,0
		CSE				11,3	11,3
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	8,0
		CSEO				2,0	16,0
		CSE				< 2,0	11,3
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	1,0-2,0			2,0-4,0	1,3
		CMEO	2,2			2,2	2,2
		CSEO	4,4			4,4	4,4
		CSE	3,1			3,1	3,1
C. dubia Survie	UT_L	CL_{50}		3,2		2,0	
		CMEO		2,0		2,0	
		CSEO		4,0		4,0	
		CSE		2,8		2,8	
C. dubia Reproduction	UT_{SC}	CMEO		8,0		4,0	
		CSEO		16,0		8,0	
		CSE		11,3		5,6	
D. magna[1]	UT_L	CL_{50}	3,2	1,6	2,0		
P. promelas[1]	UT_L	CL_{50}		5,4			
		CMEO		4,0			
		CSEO		8,0			
		CSE		5,6			
	UT_{SA}	CI_{50}		< 8,0			
		CMEO		< 8,0			
		CSEO		8,0			
		CSE		< 8,0			
O. mykiss[1]	UT_L	CL_{50}	1,0	nv	1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

FARNHAM – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicités	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement Jour 1	 Jour 3	 Jour 5	Échantillon composé Non aéré	 Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				8,0	8,0
		CSEO				16,0	16,0
		CSE				11,3	11,3
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				8,0	4,0
		CSEO				16,0	8,0
		CSE				11,3	5,7
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				2,0	2,0
		CSEO				4,0	4,0
		CSE				2,8	2,8
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		1,0		< 1,0	
		CSEO		2,0		1,0	
		CSE		1,4		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
	UT_{SA}	CI_{50}		< 1,0			
		CMEO		2,0			
		CSEO		4,0			
		CSE		2,8			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque **- Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.**

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

JONQUIÈRE – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicités	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité[1]	UT_{SC}	CMEO				< 2,0	2,0
		CSEO				2,0	4,0
		CSE				< 2,0	2,8
E. coli PQ37 (+ S9) Toxicité[1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_{L}	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_{L}	CL_{50}		< 1,0			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
O. mykiss[1]	UT_{L}	CL_{50}	< 1,0	nv	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

LA PRAIRIE – HIVER 1996

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				4,0	4,0
		CSEO				8,0	8,0
		CSE				5,7	5,7
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			1,0-2,0	< 1,0
		CMEO	< 1,0			1,1	< 1,0
		CSEO	1,0			2,2	1,0
		CSE	< 1,0			1,6	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1	< 1	< 1		
P. promelas[1]	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		1,0	
		CSEO		1,0		1,8	
		CSE		< 1,0		1,3	
	UT_{SA}	CI_{50}		< 1,0		< 1,0	
		CMEO		3,2		1,0	
		CSEO		5,9		1,8	
		CSE		4,3		1,3	
O. mykiss[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

LONGUEUIL (CERS) – HIVER 1996

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG$_{SC}$	CMEO				4,0	< 2,0
		CSEO				8,0	2,0
		CSE				5,7	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT$_{SC}$	CMEO				< 2,0	4,0
		CSEO				2,0	8,0
		CSE				< 2,0	5,7
E. coli PQ37 (+ S9) Toxicité [1]	UT$_{SC}$	CMEO				< 2,0	4,0
		CSEO				2,0	8,0
		CSE				< 2,0	5,7
S. capricornutum	UT$_{SC}$	CI$_{50}$	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT$_{L}$	CL$_{50}$		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT$_{SC}$	CMEO		1,0		1,0	
		CSEO		2,0		2,0	
		CSE		1,8		1,8	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT$_{L}$	CL$_{50}$		< 1,0			
		CMEO		1,0			
		CSEO		1,8			
		CSE		1,3			
	UT$_{SA}$	CI$_{50}$		1,2			
		CMEO		5,9			
		CSEO		11,1			
		CSE		8,3			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

MAGOG – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				2,0	< 2,0
		CSEO				4,0	2,0
		CSE				2,8	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	4,0
		CSEO				2,0	8,0
		CSE				< 2,0	5,7
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	2,0
		CSEO				2,0	4,0
		CSE				< 2,0	2,8
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		1,1			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque **- Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.**

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

MARTINVILLE – HIVER 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicité	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG$_{SC}$	CMEO				64,1	16,0
		CSEO				128,2	32,0
		CSE				90,7	22,6
E. coli PQ37 (+ S9) Génotoxicité	UG$_{SC}$	CMEO				32,0	16,0
		CSEO				64,1	32,0
		CSE				45,3	22,6
S. capricornutum	UT$_{SC}$	CI$_{50}$				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT$_{L}$	CL$_{50}$		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT$_{SC}$	CI$_{50}$		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. promelas Survie[1]	UT$_{L}$	CL$_{50}$		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
P. promelas Croissance[1]	UT$_{SA}$	CI$_{50}$		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	nv	nv	nv		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

SAINT-GÉDÉON – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
	UT_{SA}	CI_{50}		< 1,0			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
O. mykiss[1]	UT_L	CL_{50}	1,0	1,0	1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

SAINT-JOSEPH-DE-BEAUCE – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				32,0	32,0
		CSEO				64,0	64,0
		CSE				45,0	45,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				32,0	32,0
		CSEO				64,0	64,0
		CSE				45,0	45,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				8,0	4,0
		CSEO				16,0	8,0
		CSE				11,3	5,7
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				4,0	< 2,0
		CSEO				8,0	2,0
		CSE				5,7	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		1,0		1,0	
		CSEO		2,0		2,0	
		CSE		1,4		1,4	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		1,3			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		1,5			
		CMEO		7,7			
		CSEO		16,7			
		CSE		11,7			
O. mykiss[1]	UT_L	CL_{50}	1,0	1,0	1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

SAWYERVILLE- HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicités	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9)	UG_{SC}	CMEO				32,0	64,0
Génotoxicité		CSEO				64,0	128,0
		CSE				45,0	90,5
E. coli PQ37 (+ S9)	UG_{SC}	CMEO				32,0	16,0
Génotoxicité		CSEO				64,0	32,0
		CSE				45,0	22,6
E. coli PQ37 (- S9)	UT_{SC}	CMEO				16,0	8,0
Toxicité [1]		CSEO				32,0	16,0
		CSE				22,6	11,3
E. coli PQ37 (+ S9)	UT_{SC}	CMEO				2,0	< 2,0
Toxicité [1]		CSEO				4,0	2,0
		CSE				2,8	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	1,1			< 1,0	< 1,0
		CSEO	2,2			1,0	1,0
		CSE	1,6			< 1,0	< 1,0
C. dubia	UT_{L}	CL_{50}		< 1,0		< 1,0	
Survie		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia	UT_{SC}	CMEO		< 1,0		< 1,0	
Reproduction		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_{L}	CL_{50}		< 2,0			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		1,1			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
O. mykiss[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	nv		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

WARWICK – HIVER 1997

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	<2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				4,0	< 2,0
		CSEO				8,0	2,0
		CSE				5,7	< 2,0
S. capricornutum	UT_{SC}	CI_{50}	< 1,0			< 1,0	< 1,0
		CMEO	< 1,0			< 1,0	< 1,0
		CSEO	1,0			1,0	1,0
		CSE	< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_{L}	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		1,0		1,0	
		CSEO		2,0		2,0	
		CSE		1,4		1,4	
D. magna[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_{L}	CL_{50}		1,9			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		< 2,0			
		CMEO		4,0			
		CSEO		7,7			
		CSE		5,6			
O. mykiss[1]	UTL	CL_{50}	1,0	1,0	nv		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CHÂTEAUGUAY – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicité	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9)	UG_{SC}	CMEO				< 2,0	< 2,0
Génotoxicité		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9)	UG_{SC}	CMEO				< 2,0	< 2,0
Génotoxicité		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia	UT_L	CL_{50}		1,4		< 1,0	
Survie		CMEO		1,0		< 1,0	
		CSEO		2,0		1,0	
		CSE		1,4		< 1,0	
C. dubia	UT_{SC}	CI_{50}		1,2		< 1,0	
Reproduction		CMEO		1,0		< 1,0	
		CSEO		2,0		1,0	
		CSE		1,4		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas	UT_L	CL_{50}		< 1,0			
Survie[1]		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
P. promelas	UT_{SA}	CI_{50}		< 1,0			
Croissance[1]		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	1,5	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUM – ÉTÉ 1998

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicité	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Cytotoxicité [1]	UT$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Cytotoxicité [1]	UT$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT$_{SC}$	CI$_{50}$				< 1,0	entre 1,0 et 2,0
		CMEO				< 1,0	2,2
		CSEO				1,0	4,4
		CSE				< 1,0	3,1
C. dubia Survie	UT$_{L}$	CL$_{50}$		< 1,0		entre 1,0 et 2,0	
		CMEO		< 1,0		1,0	
		CSEO		1,0		2,0	
		CSE		< 1,0		1,4	
C. dubia Reproduction	UT$_{SC}$	CI$_{50}$		2,5		1,9	
		CMEO		2,0		4,0	
		CSEO		4,0		8,0	
		CSE		2,8		5,7	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. Promelas[1]	UT$_{L}$	CL$_{50}$					
		CMEO					
		CSEO					
		CSE					
	UT$_{SA}$	CI$_{50}$					
		CMEO					
		CSEO					
		CSE					
O. mykiss[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUM – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicité	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement		
			Jour 1	Jour 3	Jour 5
C. dubia	UT_L	CL_{50}		1,4	
Survie [1]		CMEO		1,0	
		CSEO		2,0	
		CSE		1,4	
C. dubia	UT_{SC}	CI_{50}		1,8	
Reproduction [1]		CMEO		2,0	
		CSEO		4,0	
		CSE		2,8	
D. magna	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0
P. promelas	UT_L	CL_{50}		< 1,0	
Survie [1]		CMEO		1,0	
		CSEO		2,0	
		CSE		1,4	
P. promelas	UT_{SA}	CI_{50}		1,2	
Croissance [1]		CMEO		16,7	
		CSEO		33,3	
		CSE		23,8	
O. mykiss	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUO – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9)	UG$_{SC}$	CMEO				8,0	8,0
Génotoxicité		CSEO				16,0	16,0
		CSE				11,3	11,3
E. coli PQ37 (+ S9)	UG$_{SC}$	CMEO				< 2,0	< 2,0
Génotoxicité		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT$_{SC}$	CI$_{50}$				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia	UT$_{L}$	CL$_{50}$		< 1,0		< 1,0	
Survie		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia	UT$_{SC}$	CI$_{50}$		< 1,0		< 1,0	
Reproduction		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. promelas	UT$_{L}$	CL$_{50}$		< 1,0			
Survie[1]		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
P. promelas	UT$_{SA}$	CI$_{50}$		< 1,0			
Croissance[1]		CMEO		2,0			
		CSEO		4,0			
		CSE		2,8			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

CUQ (STATION EST) – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG$_{SC}$	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT$_{SC}$	CI$_{50}$				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT$_{L}$	CL$_{50}$		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT$_{SC}$	CI$_{50}$		< 1,0		1,2	
		CMEO		< 1,0		1,0	
		CSEO		1,0		2,0	
		CSE		< 1,0		1,4	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. promelas Survie[1]	UT$_{L}$	CL$_{50}$		< 1,0			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
P. promelas Croissance[1]	UT$_{SA}$	CI$_{50}$		< 1,0			
		CMEO		2,0			
		CSEO		4,0			
		CSE		2,8			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

COOKSHIRE – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	**Unités de mesure**	**Paramètres de mesure**	**Jour 1**	**Jour 3**	**Jour 5**	**Non aéré**	**Aéré**
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				2,0	< 2,0
		CSEO				4,0	2,0
		CSE				2,8	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				8,0	4,0
		CSEO				16,0	8,0
		CSE				11,3	5,6
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT_{L}	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CI_{50}		2,2		3,0	
		CMEO		2,0		2,0	
		CSEO		4,0		4,0	
		CSE		2,8		2,8	
D. magna[1]	UT_{L}	CL_{50}	< 1,0	2,9	1,4		
P. promelas Survie[1]	UT_{L}	CL_{50}		1,5			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
P. promelas Croissance[1]	UT_{SA}	CI_{50}		1,9			
		CMEO		8,3			
		CSEO		16,6			
		CSE		11,7			
O. mykiss[1]	UT_{L}	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

FARNHAM – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicité	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement			Échantillon composé	
			Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				16,0	8,0
		CSEO				32,0	16,0
		CSE				22,6	11,3
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CI_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas Survie[1]	UT_L	CL_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
P. promelas Croissance[1]	UT_{SA}	CI_{50}		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

JONQUIÈRE – ÉTÉ 1998

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 2	Jour 3	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Cytotoxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Cytotoxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CI_{50}		1,8		2,1	
		CMEO		8,0		2,0	
		CSEO		16,0		4,0	
		CSE		11,3		2,8	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. Promelas[1]	UT_L	CL_{50}		3,5			
		CMEO		8,0			
		CSEO		16,0			
		CSE		11,3			
	UT_{SA}	CI_{50}		3,2			
		CMEO		4,0			
		CSEO		8,0			
		CSE		5,6			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

LA PRAIRIE – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG$_{SC}$	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT$_{SC}$	CI$_{50}$				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT$_{L}$	CL$_{50}$		1,4		1,5	
		CMEO		1,0		1,0	
		CSEO		2,0		2,0	
		CSE		1,4		1,4	
C. dubia Reproduction	UT$_{SC}$	CI$_{50}$		1,5		1,5	
		CMEO		2,0		1,0	
		CSEO		4,0		2,0	
		CSE		2,8		1,4	
D. magna[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		
P. promelas Survie[1]	UT$_{L}$	CL$_{50}$		2,1			
		CMEO		2,0			
		CSEO		4,0			
		CSE		2,8			
P. promelas Croissance[1]	UT$_{SA}$	CI$_{50}$		1,0-2,0			
		CMEO		2,0			
		CSEO		4,0			
		CSE		2,8			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	1,4	1,7	1,9		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

LONGUEUIL (CERS) – ÉTÉ 1998

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				2,0	< 2,0
		CSEO				4,0	2,0
		CSE				2,8	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Cytotoxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Cytotoxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT_{L}	CL_{50}		7,4		2,4	
		CMEO		8,0		2,0	
		CSEO		16,0		4,0	
		CSE		11,3		2,8	
C. dubia Reproduction	UT_{SC}	CI_{50}		8,4		5,5	
		CMEO		8,0		4,0	
		CSEO		16,0		8,0	
		CSE		11,3		5,6	
D. magna[1]	UT_{L}	CL_{50}	3,0	1,4	1,3		
P. Promelas[1]	UT_{L}	CL_{50}		n.d.			
		CMEO		n.d.			
		CSEO		n.d.			
		CSE		n.d.			
	UT_{SA}	CI_{50}		n.d.			
		CMEO		n.d.			
		CSEO		n.d.			
		CSE		n.d.			
O. mykiss[1]	UT_{L}	CL_{50}	2,8	2,8	1,4		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

n.d. - Non déterminé.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

LONGUEUIL (CERS) – ÉTÉ 1999

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

Tests de toxicité	Unités de mesure	Paramètres de mesure	Échantillon de renouvellement		
			Jour 1	Jour 3	Jour 5
C. dubia Survie	UT_L	CL_{50}		< 1,0	
		CMEO		1,0	
		CSEO		2,0	
		CSE		1,4	
C. dubia Reproduction	UT_{SC}	CI_{50}		1,5	
		CMEO		1,0	
		CSEO		2,0	
		CSE		1,4	
D. magna	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0
P. promelas Survie	UT_L	CL_{50}		1,4	
		CMEO		1,0	
		CSEO		2,0	
		CSE		1,4	
P. promelas Croissance	UT_{SA}	CI_{50}		1,0-2,0	
		CMEO		< 2,0	
		CSEO		2,0	
		CSE		< 2,0	
O. mykiss	UT_L	CL_{50}	1,3	< 1,0	< 1,0

Remarque **- Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.**

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

MARTINVILLE – ÉTÉ 1996

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement				Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 0	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}					< 2,0	< 2,0
		CMEO					< 2,0	< 2,0
		CSEO					2,0	2,0
		CSE					< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO					< 2,0	< 2,0
		CSEO					2,0	2,0
		CSE					< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO					< 2,0	< 2,0
		CSEO					2,0	2,0
		CSE					< 2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO					< 2,0	< 2,0
		CSEO					2,0	2,0
		CSE					< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO					< 2,0	< 2,0
		CSEO					2,0	2,0
		CSE					< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}		< 1,0			< 1,0	< 1,0
		CMEO		< 1,0			< 1,0	< 1,0
		CSEO		1,0			1,0	1,0
		CSE		< 1,0			< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}			< 1,0		< 1,0	
		CMEO			< 1,0		< 1,0	
		CSEO			1,0		1,0	
		CSE			< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO			< 1,0		< 1,0	
		CSEO			1,0		1,0	
		CSE			< 1,0		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}			< 1,0		< 1,0	
		CMEO			< 1,0		< 1,0	
		CSEO			1,0		1,0	
		CSE			< 1,0		< 1,0	
	UT_{SA}	CI_{50}			< 1,0		< 1,0	
		CMEO			< 1,0		< 1,0	
		CSEO			1,0		1,0	
		CSE			< 1,0		< 1,0	
O. mykiss[1]	UT_L	CL_{50}	nv	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

SAINT-GÉDÉON – ÉTÉ 1998

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 2	Jour 3	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Cytotoxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Cytotoxicité [1]	UT_{SC}	CMEO				2,0	< 2,0
		CSEO				4,0	2,0
		CSE				2,83	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				entre 1et 2	< 1,0
		CMEO				1,1	1,1
		CSEO				2,2	2,2
		CSE				1,6	1,6
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CI_{50}		2,1		≈ 1,0	
		CMEO		8,0		2,0	
		CSEO		16,0		4,0	
		CSE		11,3		2,8	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. Promelas[1]	UT_L	CL_{50}		1,4			
		CMEO		1,0			
		CSEO		2,0			
		CSE		1,4			
	UT_{SA}	CI_{50}		1,5			
		CMEO		2,0			
		CSEO		4,0			
		CSE		2,8			
O. mykiss[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

SAINT-JOSEPH-DE-BEAUCE – ÉTÉ 1998

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicité	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT$_{SA}$	CI$_{50}$				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (- S9) Génotoxicité	UG$_{SC}$	CMEO				16,0	16,0
		CSEO				32,0	32,0
		CSE				22,6	22,6
E. coli PQ37 (+ S9) Génotoxicité	UG$_{SC}$	CMEO				8,0	8,0
		CSEO				16,0	16,0
		CSE				11,3	11,3
E. coli PQ37 (- S9) Cytotoxicité [1]	UT$_{SC}$	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
E. coli PQ37 (+ S9) Cytotoxicité [1]	UT$_{SC}$	CMEO				8,0	< 2,0
		CSEO				16,0	2,0
		CSE				11,3	< 2,0
S. capricornutum	UT$_{SC}$	CI$_{50}$				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT$_{L}$	CL$_{50}$		7,4		8,0	
		CMEO		8,0		8,0	
		CSEO		16,0		16,0	
		CSE		11,3		11,3	
C. dubia Reproduction	UT$_{SC}$	CI$_{50}$		8,5		8,4	
		CMEO		8,0		8,0	
		CSEO		16,0		16,0	
		CSE		11,3		11,3	
D. magna[1]	UT$_{L}$	CL$_{50}$	1,4	1,4	< 1,0		
P. Promelas[1]	UT$_{L}$	CL$_{50}$		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
	UT$_{SA}$	CI$_{50}$		< 1,0			
		CMEO		< 1,0			
		CSEO		1,0			
		CSE		< 1,0			
O. mykiss[1]	UT$_{L}$	CL$_{50}$	< 1,0	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

SAWYERVILLE – ÉTÉ 1996

SOMMAIRE DES RÉSULTATS POUR LES TESTS DE TOXICITÉ DE L'EFFLUENT DE LA STATION D'ÉPURATION

			Échantillon de renouvellement			Échantillon composé	
Tests de toxicités	Unités de mesure	Paramètres de mesure	Jour 1	Jour 3	Jour 5	Non aéré	Aéré
V. fischeri	UT_{SA}	CI_{50}				< 2,0	< 2,0
		CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				<2,0	<2,0
E. coli PQ37 (- S9) Génotoxicité	UG_{SC}	CMEO				2,0	< 2,0
		CSEO				4,0	2,0
		CSE				2,8	< 2,0
E. coli PQ37 (+ S9) Génotoxicité	UG_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				<2,0	< 2,0
E. coli PQ37 (- S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
E. coli PQ37 (+ S9) Toxicité [1]	UT_{SC}	CMEO				< 2,0	< 2,0
		CSEO				2,0	2,0
		CSE				< 2,0	< 2,0
S. capricornutum	UT_{SC}	CI_{50}				< 1,0	< 1,0
		CMEO				< 1,0	< 1,0
		CSEO				1,0	1,0
		CSE				< 1,0	< 1,0
C. dubia Survie	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		< 1,0	
		CSEO		1,0		1,0	
		CSE		< 1,0		< 1,0	
C. dubia Reproduction	UT_{SC}	CMEO		1,0		< 1,0	
		CSEO		2,0		1,0	
		CSE		1,4		< 1,0	
D. magna[1]	UT_L	CL_{50}	< 1,0	< 1,0	< 1,0		
P. promelas[1]	UT_L	CL_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		11,0	
		CSEO		1,0		100,0	
		CSE		< 1,0		33,3	
	UT_{SA}	CI_{50}		< 1,0		< 1,0	
		CMEO		< 1,0		3,0	
		CSEO		1,0		6,0	
		CSE		< 1,0		4,3	
O. mykiss[1]	UT_L	CL_{50}	nv	< 1,0	< 1,0		

Remarque - Les espaces gris indiquent que les tests concernés n'ont pas été effectués avec ces échantillons.

nv - Résultat non valide.

[1] - Résultats non intégrés dans le calcul de l'indice BEEP.

APPENDIX 7

RESULTS OF THE PHYSICO-CHEMICAL ANALYSES USED TO SUPPORT TOXICITY TESTS

PHYSICO-CHEMICAL ANALYSES USED TO SUPPORT TOXICITY TESTS

The two following tables present the results of winter and summer physico-chemical support analyses conducted on samples taken for toxicity testing. When the tests were performed, all samples respected the requirements relative to pH, temperature and dissolved oxygen rate, as described in the protocols.

In winter, almost all measurements of total residual chlorine (TRC) indicated relatively high concentrations of free chlorine and combined chlorine (e.g. chloramines). For the most part, they exceeded the limit set by MENV for the protection of aquatic life, or 2 µg/L, based on figures of the Canadian Council of Resource and Environment Ministers (CCREM, 1987; MENVIQ, 1990). These results may nonetheless be called into question since they are very close to the detection limit. The results of samples from the CUO are particularly high. It is possible that the high concentration of SM noted in the CUO samples caused interference when the TRC readings were taken, as measurements performed on a sample after settling revealed concentrations on the order of 0.02 mg/L. In summer, results for TRC were almost all below 0.02 mg/L.

The TRC concentration is an important factor in the toxicological assessment, primarily for sensitive organisms such as *D. magna* and *O. mykiss*. The LC_{50}'s reported in the literature for these species are, respectively, 0.03 mg/L and 0.06 mg/L (U.S. EPA, 1985). We were unable, based on a comparison of toxic responses in these two species and TRC levels measured in winter in effluent, to determine a causal relationship between these two types of parameters. Indeed, despite an elevated concentration of TRC, the effluent of the CUO caused no mortality in *D. magna* or *O. mykiss* whereas effluent from the Cookshire treatment plant, with TRC levels close to the detection limit, proved to be lethal to both these organisms. Measurements of TRC might have been affected by the organic matter contained in this type of sample[1].

The conductivity of samples drawn from the La Prairie, Châteauguay, the CUM, the CUO and the CUQ, Longueuil, Saint-Joseph-de-Beauce, and Cookshire plants, in winter, were relatively high (conductivity > 1000 $\mu S.cm^{-1}$), suggesting significant concentrations of chlorines and sulfates were present in these effluents. These values are nonetheless far from those associated with industrial effluents, which can exceed 10 000 $\mu S.\ cm^{-1}$ (APHA, AWWA and WEF, 1992).

Analyses of TOC before and after aeration revealed a slight reduction in the load of organic substances in the majority of samples (winter and summer) after five days of aeration. For winter effluent in the municipality of Saint-Gédéon, this load was reduced to below the detection limit (< 0.1 mg/L). This result is highly surprising and should be called into question.

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[1] See description of analytical method in *Standard Methods for the Examination of Water and Wastewater*, 18th edition (APHA, AWWA and WEF, 1992).

RESULTS OF THE PHYSICO-CHEMICAL PARAMETERS USED TO SUPPORT TOXICITY TESTS

WINTER SAMPLING

Provenance des échantillons	Saison	Échantillon	T°	pH	OD %	Conductivité[a] (μS.cm^{-1})	CRT[b] mg.L^{-1}	COT[c]	
								av. aér.	ap. aér.
Châteauguay	Hiver 97	J 1	8,5	7,4	77	997	0,01	9,2	7,7
		J 3	10,6	7,3	83	1762	0,01		
		J 5	10,6	7,3	81	1222	0,02		
CUM	Hiver 96	J 1	6,9	7,2	56	998	< 0,01	29,2	16,1
		J 3	7,0	7,1	61	1018	< 0,01		
		J 5	8,9	7,2	69	1049	< 0,01		
CUO	Hiver 97	J 1	9,3	6,9	50	1514	0,20	23,4	12,5
		J 3	9,5	7,2	53	789	0,21		
		J 5	11,2	7,2	54	763	0,15		
CUQ (station Est)	Hiver 97	J 1	6,9	6,9	76	1729	< 0,01	20,7	11,4
		J 3	5,0	7,5	74	928	< 0,01		
		J 5	7,2	7,3	70	1737	< 0,01		
Cookshire	Hiver 97	J 1	6,6	7,3	97	1560	0,02	54,5	26,3
		J 3	3,1	7,3	90	1577	< 0,01		
		J 5	2,5	7,3	88	1589	< 0,01		
Farnham	Hiver 97	J 1	4,5	6,6	42	446	0,01	28,2	20,5
		J 3	1,8	6,9	81	660	0,02		
		J 5	3,3	6,9	78	471	< 0,01		
Jonquière	Hiver 97	J 1	3,6	6,7	86	369	0,03	10,1	10,1
		J 3	3,6	6,7	87	364	0,02		
		J 5	5,0	6,7	87	365	0,02		
La Prairie	Hiver 96	J 1	12,6	7,2	90	1140	0,02	13,0	10,3
		J 3	8,6	7,1	81	1281	0,01		
		J 5	7,0	7,2	62	1357	0,02		
Longueuil	Hiver 96	J 1	8,6	7,3	58	1043	0,03	19,3	11,2
		J 3	11,4	7,4	68	1025	0,01		
		J 5	12,4	7,3	70	1029	0,01		
Magog	Hiver 97	J 1	8,5	7,2	90	646	0,07	7,8	7,3
		J 3	9,5	6,9	98	768	0,03		
		J 5	7,6	6,9	87	824	0,07		
Martinville	Hiver 99	J 1	14,3	7,0	67	464	< 0,02	12,7	12,2
		J 3	13,9	7,2	67	435	< 0,02		
		J 5	14,8	7,7	71	407	< 0,02		
Saint-Gédéon	Hiver 97	J 1	9,6	7,2	86	777	0,03	16,0	< 0,1
		J 3	9,9	7,2	85	774	0,03		
		J 5	9,7	7,2	88	772	0,01		
St-Jos.-de-Beauce	Hiver 97	J 1	2,6	7,2	92	1146	0,06	21,3	14,0
		J 3	2,5	7,2	85	1179	0,06		
		J 5	4,1	7,2	86	1231	0,03		

RESULTS OF THE PHYSICO-CHEMICAL PARAMETERS USED TO SUPPORT TOXICITY TESTS

WINTER SAMPLING (CONTINUED)

Provenance des échantillons	Saison	Échantillon	T°	pH	OD %	Conductivité[a] (µS.cm^{-1})	CRT[b] mg.L^{-1}	COT[c] av. aér.	COT[c] ap. aér.
Sawyerville	Hiver 97	J 1	10,0	6,4	100	630	0,07	13,1	9,2
		J 3	2,7	7,4	92	626	0,01		
		J 5	1,8	7,4	89	632	0,02		
Warwick	Hiver 97	J 1	12,8	7,0	94	926	0,06	21,7	16,2
		J 3	11,1	7,4	88	956	0,05		
		J 5	3,4	6,4	88	952	0,02		

[a]: Mesuré à 25°C.
[b]: Mesuré par titrage ampérométrique inversé ou par la méthode DPD (Hach™).
[c]: Mesuré sur l'échantillon composé.
<: Inférieur à la limite de détection.
Av. aér. : Avant traitement aérobie.
Ap. aér. : Après traitement aérobie.
COT : Carbone organique total.
CRT : Chlore résiduel total.
OD : Oxygène dissous.
nd : Non déterminé.
T° : Température.

RESULTS OF THE PHYSICO-CHEMICAL PARAMETERS USED TO SUPPORT TOXICITY TESTS

SUMMER SAMPLING

Provenance des échantillons	Saison	Échantillon	T°	pH	OD %	Conductivité[a] (µS.cm^{-1})	CRT[b] mg.L^{-1}	COT[c] av. aér.	COT[c] ap. aér.
Châteauguay	Été 99	J 1	20,7	7,1	45	819	< 0,02	7,7	6,0
		J 3	20,3	7,1	67	822	< 0,02		
		J 5	21,6	7,2	52	804	< 0,02		
CUM	Été 98	J 1	16,2	7,1	7,1	677	< 0,02	33,8	16,1
		J 3	16,4	7,0	8,3	693	< 0,02		
		J 5	13,4	7,2	7,2	686	< 0,02		
CUM	Été 99	J 1	24,3	6,9	20,0	776	< 0,02	nd	nd
		J 3	19,5	6,9	8,7	793	< 0,02		
		J 5	24,6	6,8	14,6	785	< 0,02		
CUO	Été 99	J 1	23,2	7,3	82	473	< 0,02	3,6	3,4
		J 3	18,7	7,1	84	501	< 0,02		
		J 5	17,1	7,2	88	514	< 0,02		
CUQ (station Est)	Été 99	J 1	16,4	7,1	28	786	0,03	8,8	8,4
		J 3	15,8	7,1	34	667	< 0,02		
		J 5	19,5	7,1	27	799	< 0,02		
Cookshire	Été 99	J 1	16,1	7,3	50	1034	< 0,02	13,0	12,5
		J 3	19,1	7,2	53	928	< 0,02		
		J 5	10,4	7,1	30	924	< 0,02		
Farnham	Été 99	J 1	21,2	7,4	78	674	< 0,02	9,9	9,7
		J 3	20,0	7,3	72	604	< 0,02		
		J 5	14,5	7,5	51	603	< 0,02		
Jonquière	Été 98	J 1	11,5	7,3	79	343	< 0,02	9,2	8,4
		J 3	11,9	7,3	83	358	< 0,02		
		J 5	10,4	7,3	79	376	< 0,02		
La Prairie	Été 99	J 1	19,3	7,5	62	1400	< 0,02	11,5	11,7
		J 3	19,8	7,6	77	1314	< 0,02		
		J 5	23,7	7,6	80	1099	< 0,02		
Longueuil	Été 98	J 1	20,5	7,1	29	756	< 0,02	25,7	18,2
		J 3	18,9	7,1	17	714	< 0,02		
		J 5	18,7	7,3	21	748	< 0,02		
Longueuil	Été 99	J 1	21,4	6,9	10,3	831	< 0,02	nd	nd
		J 3	20,3	7,0	9,7	830	< 0,02		
		J 5	21,6	6,9	10,5	811	< 0,02		
Martinville	Été 96	J 0	10,7	8,3	97	423	< 0,01	25,4	26,3
		J 1	10,3	8,8	93	418	< 0,01		
		J 3	7,2	8,7	98	408	< 0,01		
		J 5	6,2	8,8	96	404	< 0,01		
Saint-Gédéon	Été 98	J 1	12,2	7,7	80	585	0,02	13,1	11,5
		J 3	12,1	7,7	81	581	0,03		
		J 5	11,5	7,7	79	576	< 0,02		

RESULTS OF THE PHYSICO-CHEMICAL PARAMETERS USED TO SUPPORT TOXICITY TESTS

SUMMER SAMPLING (CONTINUED)

Provenance des échantillons	Saison	Échantillon	T°	pH	OD %	Conductivité[a] (μS.cm^{-1})	CRT[b] mg.L^{-1}	COT[c] av. aér.	COT[c] ap. aér.
St-Jos.-de-Beauce	Été 98	J 1	13,2	6,5	75	881	< 0,02	14,9	12,3
		J 3	10,4	6,8	75	857	< 0,02		
		J 5	15,7	6,8	86	896	< 0,02		
Sawyerville	Été 96	J 1	15,2	7,8	85	523	0,04	8,8	8,0
		J 3	12,3	7,8	85	520	0,04		
		J 5	13,3	7,8	84	522	0,03		

[a] :	Mesuré à 25°C.
[b] :	Mesuré par titrage ampérométrique inversé ou par la méthode DPD (Hach™).
[c] :	Mesuré sur l'échantillon composé.
< :	Inférieur à la limite de détection.
Av. aér. :	Avant traitement aérobie.
Ap. aér. :	Après traitement aérobie.
COT :	Carbone organique total.
CRT :	Chlore résiduel total.
OD :	Oxygène dissous.
nd :	Non déterminé.
T° :	Température.

APPENDIX 8

RESULTS OF ANALYSES FOR PHYSICO-CHEMICAL PARAMETERS (PCP), METALS, SVOCs, VOCs AND PHENOLS

Winter sampling: pages 85 to 108
Summer sampling: pages 109 to 134

Legend of tables for appendix 8:

LDM : detection limit of the analytical method
< : daily result below detection limit
< LIM : mean concentration below detection limit
** : result rejected (quality control)
( ) : questionable result (quality control); to be considered with caution

CHÂTEAUGUAY - HIVER 1997

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1997/01/20-21		1997/01/22-23		1997/01/24-25		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	08H00 À 08H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	18633		34345		23571		25516		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	9,58	179	8,76	301	6,62	156	8,32	212	0,03
700	Azote Kjeldahl total (N-NKT)	11,50	214	8,48	291	6,42	151	8,80	219	0,03
870	Carbone organique total (COT)	**		**		**		<LIM		0,15
640	Chlorures (Cl-)	132	2460	383	13154	211	4973	242	6862	0,06
634	Cyanates (CNO-)	0,22	4	<		2,20	52	0,81	19	0,18
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	**		**		**		<LIM		6
	DBO5 carbonée	**		**		**		<LIM		5
820	Demande chimique en oxygène (DCO)	**		**		**		<LIM		9
650	Fluorures totaux (F-)	0,83	15	0,74	25	0,65	15	0,74	19	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	0,31	6	1,1	38	0,66	16	0,69	20	0,09
110	Matières en suspension	11	205	14	481	9	212	11	299	3
181	Matières extractibles au fréon (Huiles et graisses totales)	0,60	11	1,4	48	0,87	21	0,96	27	0,06
	Nitrites (NO2)	0,193	4	0,200	7	0,188	4	0,194	5	0,006
	Nitrates (NO3)	2,50	47	2,07	71	2,09	49	2,22	56	0,03
680	Nitrites-nitrates (NO2-NO3)	2,690	50	2,270	78	2,280	54	2,413	61	0,003
674	Phosphore total (P tot.)	**		**		**		<LIM		0,05
135	Solides totaux (ST)	571	10639	972	33383	689	16240	744	20088	6
610	Sulfates (SO42-)	73,40	1368	71,10	2442	74,20	1749	72,90	1853	0,08
620	Sulfures totaux (S2-)	0,04	1	0,07	2	0,06	1	0,06	2	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	0,05	1	0,06	2	0,08	2	0,06	2	0,034
	Aluminium dissous	<		<		<		<LIM		0,03
410	Argent total	<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	(0,019)	(0,4)	(0,014)	(0,5)	(0,019)	(0,4)	(0,017)	(0,4)	0,0003
440	Cuivre total	0,046	1	0,039	1	0,036	1	0,040	1	0,001
460	Fer total	1,25	23	1,30	45	1,35	32	1,30	33	0,017
	Fer dissous	0,12	2	0,07	2	0,11	3	0,10	2	0,03
351	Mercure total	<		<		<		<LIM		0,0003
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	<		<		<		<LIM		0,0006
310	Sélénium total	<		<		<		<LIM		0,0003
330	Zinc total	0,07	1	0,06	2	0,08	2	0,07	2	0,0028

CUM - HIVER 1996

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1996/12/09-10		1996/12/11-12		1996/12/13-14		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	14H30 À 14H30		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	2478780		2413440		2753280		2548500		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	4,85	12022	8,38	20225	6,58	18117	6,60	16788	0,03
700	Azote Kjeldahl total (N-NKT)	8,77	21739	9,68	23362	9,68	26652	9,38	23918	0,03
870	Carbone organique total (COT)	**		**		**		<LIM		0,15
640	Chlorures (Cl-)	174	431308	166	400631	206	567176	182	466371	0,06
634	Cyanates (CNO-)	<		0,23	555	<		<LIM		0,18
631	Cyanures totaux (CN- tot.)	<		0,03	72	0,04	110	<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	**		**		**		<LIM		6
	DBO5 carbonée	**		**		**		<LIM		5
820	Demande chimique en oxygène (DCO)	**		**		**		<LIM		9
650	Fluorures totaux (F-)	0,23	570	0,24	579	0,21	578	0,23	576	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	0,34	843	0,19	459	<		0,18	434	0,09
110	Matières en suspension	19	47097	27	65163	58	159690	35	90650	3
181	Matières extractibles au fréon (Huiles et graisses totales)	5,14	12741	4,96	11971	4,76	13106	4,95	12606	0,06
	Nitrites (NO2)	0,026	64	<		<		0,009	21	0,006
	Nitrates (NO3)	0,63	1562	<		<		0,21	521	0,03
680	Nitrites-nitrates (NO2-NO3)	0,660	1636	<		<		0,220	545	0,003
674	Phosphore total (P tot.)	**		**		**		<LIM		0,05
135	Solides totaux (ST)	605	1499662	570	1375661	622	1712540	599	1529288	6
610	Sulfates (SO42-)	68,00	168557	72,40	174733	63,50	174833	67,97	172708	0,08
620	Sulfures totaux (S2-)	0,04	99	0,04	97	0,04	110	0,04	102	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	0,16	397	0,17	410	0,10	275	0,14	361	0,034
600	Aluminium dissous	0,16	397	0,16	386	0,19	523	0,17	435	0,04
410	Argent total	<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	0,029	72	0,020	48	0,028	77	0,026	66	0,0003
440	Cuivre total	0,025	62	0,016	39	0,020	55	0,020	52	0,001
460	Fer total	1,90	4710	1,60	3862	1,75	4818	1,75	4463	0,017
	Fer dissous	0,140	347	<		1,30	3579	0,48	1309	0,03
351	Mercure total	<		<		<		<LIM		0,0003
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	<		<		<		<LIM		0,0008
310	Sélénium total	(0,0038)	(9)	(0,0018)	(4)	(0,0014)	(4)	(0,0023)	(6)	0,0002
330	Zinc total	0,07	174	0,06	145	0,10	275	0,08	198	0,0028
	Biphényles polychlorés (BPC)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
3190	Arochlor 1242	<		<		<		<LIM		0,3
3200	Arochlor 1248	<		<		<		<LIM		0,7
3210	Arochlor 1254	<		<		<		<LIM		0,7
3220	Arochlor 1260	<		<		<		<LIM		0,3
	(HAP)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,08
11020	Acénaphthylène	**		**		**		<LIM		0,09
11030	Anthracène	<		<		<		<LIM		0,10
11040	Benzo (a) anthracène	<		<		<		<LIM		0,10
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,10
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,08
11080	Benzo (a) pyrène	<		<		<		<LIM		0,09
16020	2-Chloronaphtalène	**		**		**		<LIM		0,05
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,10
11082	Dibenzo (a,i) pyrène	0,14	347	<		<		<LIM		0,10
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,10
11090	Chrysène	<		<		<		<LIM		0,10
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,09
11110	Fluoranthène	<		<		<		<LIM		0,10
11120	Fluorène	<		<		<		<LIM		0,10
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,10
11189	1-Méthylnaphtalène	**		**		**		<LIM		0,04
11190	2-Méthylnaphtalène	**		**		**		<LIM		0,04
11141	1,2,3,4-Tétrahydronaphtalène	**		**		**		<LIM		0,03
11140	Naphtalène	**		**		**		<LIM		0,05
11150	Phénanthrène	0,11	273	0,11	265	<		<LIM		0,10
11160	Pyrène	<		<		<		<LIM		0,10
	Substances phénoliques	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
	Catéchol	<		<		<		<LIM		2
	4-Chlorocatéchol	<		<		<		<LIM		2
	4-Chloroguaiacol	<		<		<		<LIM		2
4020	2-Chlorophénol	<		<		<		<LIM		3
	3-Chlorophénol	<		<		<		<LIM		2
	4-Chlorophénol	<		<		<		<LIM		2
	6-Chlorovanilline	**		**		**		<LIM		2
	3,5-Dichlorocatéchol	<		<		<		<LIM		2
	4,5-Dichlorocatéchol	<		<		<		<LIM		2
	4,5-Dichloroguaiacol	<		<		<		<LIM		1
	4,6-Dichloroguaiacol	<		<		<		<LIM		3
	2,3-Dichlorophénol	<		<		<		<LIM		2
	2,4 + 2,5-Dichlorophénol	<		<		<		<LIM		2
	2,6-Dichlorophénol	<		<		<		<LIM		2
	3,4-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		2

CUM - HIVER 1996

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1996/12/09-10		1996/12/11-12		1996/12/13-14		MOYENNE ARITHMÉTIQUE		LDM
	HEURE	14H30 À 14H30		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	2478780		2413440		2753280		2548500		
CODE	**PARAMETRE**									
	5,6-Dichlorovanilline	<		<		<		<LIM		2
	4,5-Dichlorovératrol	<		<		<		<LIM		3
	2,4-Diméthylphénol	<		<		<		<LIM		4
	Eugénol	<		<		<		<LIM		2
	Guaiacol	<		<		<		<LIM		3
	Isoeugénol	**		**		**		<LIM		1
	m-Crésol	<		<		<		<LIM		2
	o-Crésol	<		<		<		<LIM		2
	p-Crésol	<		<		<		<LIM		3
4060	2,4-Dinitrophénol	<		<		<		<LIM		3
4070	2-Nitrophénol	<		<		<		<LIM		1
4080	4-Nitrophénol	<		<		<		<LIM		3
4090	Pentachlorophénol	<		<		<		<LIM		3
4100	Phénol	<		<		<		<LIM		2
	Tétrachlorocatéchol	<		<		<		<LIM		3
	Tétrachloroguaiacol	<		<		<		<LIM		2
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,4,6-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,5,6-Tétrachlorophénol	<		<		<		<LIM		2
	3,4,5,6-Tétrachlorovératrol	<		<		<		<LIM		1
	3,4,5-Trichlorocatéchol	<		<		<		<LIM		3
	3,4,5-Trichloroguaiacol	<		<		<		<LIM		3
	4,5,6-Trichloroguaiacol	<		<		<		<LIM		3
	2,3,4-Trichlorophénol	<		<		<		<LIM		3
	2,3,5-Trichlorophénol	<		<		<		<LIM		3
	2,3,6-Trichlorophénol	<		<		<		<LIM		1
	2,4,5-Trichlorophénol	<		<		<		<LIM		2
4110	2,4,6-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorophénol	<		<		<		<LIM		1
	3,4,5-Trichlorosyringol	<		<		<		<LIM		2
	3,4,5-Trichlorovératrol	<		<		<		<LIM		2
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	**		**		**		<LIM		2,70
5020	Acrylonitrile	**		**		**		<LIM		2,50
2010	Benzène	0,60	1487	<		<		<LIM		0,40
2020	Bromodichlorométhane	0.80	1983	0.50	1207	0.70	1927	0,67	1706	0,50
2030	Bromoforme	<		<		<		<LIM		0,70
2040	Bromométhane	**		**		**		<LIM		1,15
2202	n-Butylbenzène	<		<		<		<LIM		0,50
2203	tert-Butylbenzène	<		<		<		<LIM		0,40
2060	Chlorobenzène	<		<		<		<LIM		0,40
2211	Chlorure de benzyle	**		**		**		<LIM		0,70
2070	Chloroéthane	**		**		**		<LIM		1,50
	Chloroéthylène	<		<		<		<LIM		0,90
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		0,90
2100	Chlorométhane	**		**		**		<LIM		1,10
2080	bis-Chlorométhyl éther	**		**		**		<LIM		1,00
2120	Dibromochlorométhane	**		**		**		<LIM		0,50
12010	1,2-Dichlorobenzène	0,90	2231	0,60	1448	0,70	1927	0,73	1869	0,50
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,40
12030	1,4-Dichlorobenzène	<		<		<		<LIM		0,50
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,40
2150	1,2-Dichloroéthane	**		**		**		<LIM		0,20
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,70
2400	cis-1,2-Dichloroéthylène	0,80	1983	0,30	724	<		0,37	902	0,30
2170	trans-1,2-Dichloroéthylène	**		**		**		<LIM		0,70
2130	Dichlorodifluorométhane	**		**		**		<LIM		1,00
2180	1,2-Dichloropropane	<		<		<		<LIM		0,40
	cis-1,3-Dichloropropène	<		<		<		<LIM		0,40
	trans-1,3-Dichloropropène	<		<		<		<LIM		0,20
2200	Éthylbenzène	2,50	6197	1,40	3379	2,40	6608	2,10	5395	0,40
2115	Éther éthylique	**		**		**		<LIM		0,50
	o-xylène	1,30	3222	0,80	1931	1,30	3579	1,13	2911	0,40
	p,m-xylènes	0,70	1735	0,50	1207	0,70	1927	0,63	1623	0,40
2245	Styrène	0,50	1239	0,40	965	0,90	2478	0,60	1561	0,30
2050	Tétrachlorure de carbone	**		**		**		<LIM		0,60
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		0,60
	1,1,2,2-Tétrachloroéthylène	4,10	10163	4,10	9895	2,40	6608	3,53	8889	0,40
2162	1,2,3,4-Tétraméthylbenzène	**		**		**		<LIM		0,70
2240	Toluène	23,00	57012	3,30	7964	6,20	17070	10,83	27349	0,20
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,50
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,30
2270	Trichloroéthylène	<		<		0,60	1652	<LIM		0,50
2163	1,2,3-Triméthylbenzène	**		**		**		<LIM		1,10
2164	1,2,4-Triméthylbenzène	2,00	4958	1,90	4586	1,80	4956	1,90	4833	0,60
2165	1,3,5-Triméthylbenzène	0,50	1239	0,50	1207	0,50	1377	0,50	1274	0,40

CUO - HIVER 1997

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1997/01/06-07		1997/01/08-09		1997/01/10-11		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	08H00 À 08H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	150555		128023		124747		134442		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	4,73	712	5,90	755	7,89	984	6,17	817	0,03
700	Azote Kjeldahl total (N-NKT)	8,47	1275	18,30	2343	12,30	1534	13,02	1717	0,03
870	Carbone organique total (COT)	**		**		**		<LIM		0,15
640	Chlorures (Cl-)	389	58566	131	16771	114	14221	211	29853	0,06
634	Cyanates (CNO-)	1,08	163	2,46	315	2,12	264	1,89	247	0,18
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	**		**		**		<LIM		6
	DBO5 carbonée	**		**		**		<LIM		5
820	Demande chimique en oxygène (DCO)	**		**		**		<LIM		9
650	Fluorures totaux (F-)	0,24	36	0,15	19	0,11	14	0,17	23	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	<		<		<		<LIM		0,09
110	Matières en suspension	59	8883	167	21380	89	11102	105	13788	3
181	Matières extractibles au fréon (Huiles et graisses totales)	1,30	196	1.40	179	1,10	137	1,27	171	0,06
	Nitrites (NO2)	<		<		<		<LIM		0,006
	Nitrates (NO3)	4,21	634	5,30	679	5,19	647	4,90	653	0,03
680	Nitrites-nitrates (NO2-NO3)	4,210	634	5,300	679	5,190	647	4,900	653	0,003
674	Phosphore total (P tot.)	**		**		**		<LIM		0,05
135	Solides totaux (ST)	916	137908	605	77454	487	60752	669	92038	6
610	Sulfates (SO42-)	51,20	7708	53,80	6888	55,10	6874	53,37	7157	0,08
620	Sulfures totaux (S2-)	0,09	14	0,05	6	0,07	9	0,07	10	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	1,63	245	4,25	544	2,23	278	2,70	356	0,034
	Aluminium dissous	1,38	208	3,81	488	2,05	256	2,41	317	0,04
410	Argent total	<		0,002	0,26	0,003	0,37	0,0017	0,21	0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	(0,012)	(2)	(0,012)	(2)	(0,012)	(1)	(0,012)	(2)	0,0003
440	Cuivre total	0,024	4	0,053	7	0,046	6	0,041	5	0,001
460	Fer total	2,70	406	3,80	486	3,30	412	3,27	435	0,017
	Fer dissous	0,46	69	0,39	50	0,28	35	0,38	51	0,03
351	Mercure total	0,0007	0,11	<		<		<LIM		0,0003
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	(<)		(0,0052)	(0,7)	(0,0031)	(0,4)	(0,0028)	(0,4)	0,0006
310	Sélénium total	<		<		<		<LIM		0,0003
330	Zinc total	0,09	14	0,11	14	0,08	10	0,09	13	0,0028

CUQ (station Est) - HIVER 1997

CODE	PARAMETRE	*JOUR 1*		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	JOUR-DATE	1997/01/06-07		1997/01/08-09		1997/01/10-11				
	HEURE	08H00 à 08H00		08H00 à 08H00		08H00 à 08H00				
	DÉBIT (m^3/j)	161274		151234		158989		157165,67		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	11,1	1790	11,6	1754	12,2	1940	11,6	1828	0,1
700	Azote Kjeldahl total (N-NKT)	14,7	2371	15.0	2269	15.4	2448	15,0	2363	0,2
870	Carbone organique total (COT)	16,3	2629	15,3	2314	18,1	2878	16,6	2607	0,2
640	Chlorures (Cl-)	414	66767	152	22988	393	62483	320	50746	0,05
634	Cyanates (CNO-)	<		<		<		<LIM		0,1
631	Cyanures totaux (CN- tot.)	0,01	1,6	<		0,01	1,6	<LIM		0,01
840	Demande biochimique en oxygène (DBO5)	19	3064	28	4235	44	6996	30	4765	2
	Demande biochimique en oxygène carbonée (DBO5)	16	2580	23	3478	39	6201	26	4086	3
820	Demande chimique en oxygène (DCO)	89	14353	74	11191	92	14627	85	13391	5
650	Fluorures totaux (F-)	0,77	124	0.85	129	0.78	124	0.80	126	0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	0.4	65	1.0	151	<		0,5	72	0,1
110	Matières en suspension	19	3064	22	3327	25	3975	22	3455	4
181	Matières extractibles au fréon (Huiles et graisses totales)	6.5	1048	8,3	1255	6.9	1097	7,2	1134	0,1
680	Nitrites-nitrates (NO2-NO3)	0,48	77	0,43	65	0,44	70	0,45	71	0,01
674	Phosphore total (P tot.)	1,56	252	1,69	256	1,51	240	1,59	249	0,06
135	Solides totaux (ST)	960	154823	520	78642	910	144680	797	126048	10
610	Sulfates (SO42-)	62	9999	46	6957	40	6360	49	7772	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	0,3	48,38	0,3	45,37	0,3	47,70	0,3	47,15	0,1
	Aluminium dissous	<		<		<		<LIM		0,1
410	Argent total	0.008	1,29	0,009	1,36	0.006	0.95	0,008	1,20	0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	0,002	0.32	0,006	0,91	0,006	0,95	0.005	0,73	0,001
440	Cuivre total	0.025	4.03	0.018	2,72	0.018	2,86	0,020	3,21	0,001
460	Fer total	0.83	133,86	0,83	125,52	0,95	151,04	0,87	136,81	0,02
	Fer dissous	0.27	43,54	0,25	37,81	0,34	54,06	0,29	45,14	0,02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0,01
301	Plomb total	0.0037	0,60	<		0,0007	0,11	0,0015	0,24	0,0005
310	Sélénium total	<		0,001	0,15	<		<LIM		0,001
330	Zinc total	0.04	6,45	0,05	7,56	0,04	6,36	0,04	6,79	0,01
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	**		**		**		<LIM		37
5020	Acrylonitrile	**		**		**		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		1
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	**		**		**		<LIM		19
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		3.0	477	1.0	159	1
2060	Chlorobenzène	<		<		<		<LIM		1
2211	Chlorure de benzyle	**		**		**		<LIM		1
2070	Chloroéthane	**		**		**		<LIM		17
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		10
2100	Chlorométhane	**		**		**		<LIM		22
2080	bis-Chlorométhyl éther	**		**		**		<LIM		19
2085	Chlorure de vinyle	**		**		**		<LIM		14
2120	Dibromochlorométhane	<		<		<		<LIM		1
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		4
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		1
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		1
2130	Dichlorodifluorométhane	<		<		<		<LIM		6
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		1
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		1
12060	1,2-Diméthylbenzène (o-xylène)	1.4	226	1.4	212	3.2	509	2	315	1
12070	1,3-Diméthylbenzène (m-xylène)	<		2.0	302	<		<LIM		2
12080	1,4-Diméthylbenzène (p-xylène)*									
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	**		**		**		<LIM		8
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		2
2161	1,1,2,2-Tétrachloroéthylène	4.6	742	2.6	393	1.4	223	3	453	1
2162	1,2,3,4-Tétraméthylbenzène	1	161	<		<		<LIM		1
2240	Toluène	<		<		86.1	13689	29	4563	1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		2
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	<		<		<		<LIM		1
2163	1,2,3-Triméthylbenzène	3.4	548	1.2	181	5.5	874	3	535	1
2164	1,2,4-Triméthylbenzène	9.4	1516	6.6	998	22.0	3498	13	2004	1
2165	1,3,5-Triméthylbenzène	4.8	774	2.5	378	7.1	1129	5	760	1
2243	Xylènes**	<		3.4	514	3.2	509	<LIM		3

CUQ (station Est) - HIVER 1997

CODE	PARAMETRE	JOUR 1		JOUR 3		JOUR 5		MOYENNE ARITHMÉTIQUE		LDM
	JOUR-DATE	1997/01/06-07		1997/01/08-09		1997/01/10-11				
	HEURE	08H00 a 08H00		08H00 a 08H00		08H00 a 08H00				
	DEBIT (m³/j)	161274		151234		158989		157165,67		
	Substances phénoliques	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
	Phénol	<		<		<		<LIM		2
	O-crésol	••		••		••		<LIM		2
	M-crésol	••		••		••		<LIM		2
	P-crésol	••		••		••		<LIM		1
	2-Chlorophénol	<		<		<		<LIM		1
	3-Chlorophénol	<		<		<		<LIM		1
	4-Chlorophénol	<		<		<		<LIM		1
	2,4-Diméthylphénol	••		••		••		<LIM		2
	Guaicol	••		••		••		<LIM		2
	2,6-Dichlorophénol	<		<		<		<LIM		1
	4-Chloro 3-méthylphénol	<		<		<		<LIM		1
	2,4+2,5-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		1
	Catéchol	<		<		<		<LIM		1
	2,3-Dichlorophénol	<		<		<		<LIM		1
	2-Nitrophénol	<		<		<		<LIM		1
	3,4-Dichlorophénol	<		<		<		<LIM		1
	4-Chloroguaiacol	••		••		••		<LIM		1
	2,4,6-Trichlorophénol	<		<		<		<LIM		1
	4-Nitrophénol	<		<		<		<LIM		1
	2,3,6-Trichlorophénol	<		<		<		<LIM		1
	2,3,5-Trichlorophénol	<		<		<		<LIM		2
	2,4,5-Trichlorophénol	<		<		<		<LIM		1
	4,5-Dichlorovératrol	<		<		<		<LIM		1
	Eugénol	••		••		••		<LIM		3
	4-Chlorocatéchol	<		<		<		<LIM		1
	4,6-Dichloroguaiacol	<		<		<		<LIM		1
	2,3,4-Trichlorophénol	<		<		<		<LIM		1
	3,4,5-Trichlorophénol	<		<		<		<LIM		1
	4,5-Dichloroguaiacol	<		<		<		<LIM		1
	Isoeugénol	••		••		••		<LIM		2
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		1
	3,5-Dichlorocatéchol	<		<		<		<LIM		1
	2,3,4,6-Tétrachlorophénol	<		<		<		<LIM		1
	3,4,5-Trichlorovératrol	<		<		<		<LIM		1
	6-Chlorovanilline	<		<		<		<LIM		1
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		1
	4,5-Dichlorocatéchol	<		<		<		<LIM		1
	3,4,5-Trichloroguaiacol	<		<		<		<LIM		1
	Tétrachlorovératrol	<		<		<		<LIM		1
	4,5,6-Trichloroguaiacol	<		<		<		<LIM		1
	5,6-Dichlorovanilline	<		<		<		<LIM		1
	Pentachlorophénol	<		<		<		<LIM		1
	3,4,5-Trichlorocatéchol	<		<		<		<LIM		1
	Tétrachloroguaiacol	<		<		<		<LIM		1
	3,4,5-Trichlorosyringol	••		••		••		<LIM		1
	Tétrachlorocatéchol	<		<		<		<LIM		1

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CODE	PARAMETRE									
	JOURNÉE	*JOUR 1*		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	DATE	3/02/1997		5/02/1997		7/02/1997				
	HEURE	8 H 30		7 H 30		7 H 30				
	DÉBIT (m³/j)	1213		1278		1256		1249,00		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	10	12	11	14	11	14	10,7	13	0,1
700	Azote Kjeldahl total (N-NKT)	14	17	14	18	14	18	14,0	17	0,2
870	Carbone organique total (COT)	46	56	51	65	52	65	49,7	62	0,2
640	Chlorures (Cl-)	371	450	362	463	372	467	368	460	0,05
634	Cyanates (CNO-)	<		0,7	1	0,6	1	<LIM		0,5
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,01
840	Demande biochimique en oxygène (DBO5)	21	25	20	26	35	44	25	32	2
	Demande biochimique en oxygène carbonée (DBO5)	18	22	16	20	32	40	22	27	3
820	Demande chimique en oxygène (DCO)	154	187	170	217	179	225	168	210	5
650	Fluorures totaux (F-)	0,07	0,1	0,07	0,1	0,07	0,1	0,07	0,1	0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	(16)	(19,4)	(16)	(20,5)	(17)	(21,4)	(16)	(20,4)	0,1
110	Matières en suspension	12	15	13	17	12	15	12	15	4
181	Matières extractibles au fréon (Huiles et graisses totales)	(21)	(25,5)	(22)	(28,1)	(22)	(27,6)	(22)	(27,1)	0,1
680	Nitrites-nitrates (NO2-NO3)	0,6	0,7	0,6	0,8	0,6	0,8	0,6	0,7	0,01
674	Phosphore total (P tot.)	1,5	1,8	1,5	1,9	1,5	1,9	1,5	1,9	0,06
135	Solides totaux (ST)	860	1043	890	1137	880	1105	877	1095	10
610	Sulfates (SO42-)	36	44	39	50	45	57	40	50	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	0,2	0,24	0,2	0,26	0,1	0,13	0,2	0,21	0,1
	Aluminium dissous	<		<		<		<LIM		0,1
410	Argent total	0,006	0,007	0,005	0,006	0,004	0,005	0,005	0,006	0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	0,011	0,013	0,012	0,0153	0,013	0,016	0,012	0,015	0,001
440	Cuivre total	0,041	0,050	0,041	0,052	0,037	0,046	0,040	0,050	0,001
460	Fer total	0,27	0,33	0,29	0,37	0,31	0,39	0,29	0,36	0,02
	Fer dissous	0,20	0,24	0,20	0,26	0,21	0,26	0,20	0,25	0,02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0,01
301	Plomb total	<		0,0006	0,0008	<		<LIM		0,0005
310	Sélénium total	<		<		<		<LIM		0,001
330	Zinc total	0,19	0,23	0,19	0,24	0,20	0,25	0,19	0,24	0,01
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		1
11020	Acénaphthylène	<		<		<		<LIM		1
11030	Anthracène	<		<		<		<LIM		2
11040	Benzo (a) anthracène	<		<		<		<LIM		2
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		2
11080	Benzo (a) pyrène	<		<		<		<LIM		1
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		2
11082	Dibenzo (a,i) pyrène	••		••		••		<LIM		2
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		1
11090	Chrysène	<		<		<		<LIM		2
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		2
11110	Fluoranthène	<		<		<		<LIM		2
11120	Fluorène	<		<		<		<LIM		1
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		2
11140	Naphtalène	<		<		<		<LIM		1
11150	Phénanthrène	<		<		<		<LIM		8
11160	Pyrène	<		<		<		<LIM		2
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		1
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		1
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		1
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		1
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		1
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		2
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		1
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		2
12020	1,3-Dichlorobenzène	<		<		<		<LIM		2
12030	1,4-Dichlorobenzène	<		<		<		<LIM		2
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		1
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		1
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		2
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		1
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		1
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		2
12046	Pentachlorobenzène	<		<		<		<LIM		1
12050	Hexachlorobenzène	<		<		<		<LIM		1
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		2
14020	Di-n-butylphtalate	<		2,9	3,71	2,6	3,27	<LIM		2

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	JOURNÉE	*JOUR 1*		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	DATE	3/02/1997		5/02/1997		7/02/1997				
	HEURE	8 H 30		7 H 30		7 H 30				
	DÉBIT (m³/j)	1213		1278		1256		1249,00		
CODE	**PARAMETRE**									
14030	Diéthylphtalate	<		<		<		<LIM		1
14040	Diméthylphtalate	<		<		<		<LIM		2
14050	Di-n-octylphtalate	<		<		<		<LIM		3
	Autres composés :									
16020	2-Chloronaphtalène	<		<		<		<LIM		1
16030	3,3-Dichlorobenzidine	<		<		<		<LIM		3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		1
16060	1,2-Diphénylhydrazine (sommation avec azobenzène)	<		<		<		<LIM		2
16070	Hexachlorobutadiène	<		<		<		<LIM		2
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		3
16100	Isophorone	<		<		<		<LIM		1
16110	Nitrobenzène	<		<		<		<LIM		1
16090	Hexachloroéthane	<		<		<		<LIM		2
	Substances organiques volatiles (SOV)	µg/l	g/d	µg/l	g/d	µg/l	g/d	µg/l	g/d	µg/l
5010	Acroléine	°°		°°		°°		<LIM		74
5020	Acrylonitrile	<		<		<		<LIM		6
2010	Benzène	<		<		<		<LIM		2
2020	Bromodichlorométhane	<		<		<		<LIM		2
2030	Bromoforme	<		<		<		<LIM		2
2040	Bromométhane	°°		°°		°°		<LIM		38
2202	n-Butylbenzène	<		<		<		<LIM		2
2203	tert-Butylbenzène	<		<		<		<LIM		2
2060	Chlorobenzène	<		<		<		<LIM		2
2211	Chlorure de benzyle	°°		°°		°°		<LIM		2
2070	Chloroéthane	°°		°°		°°		<LIM		34
2080	2-Chloroéthylvinyl éther	°°		°°		°°		<LIM		10
2100	Chlorométhane	°°		°°		°°		<LIM		44
2080	bis-Chlorométhyl éther	°°		°°		°°		<LIM		38
2085	Chlorure de vinyle	°°		°°		°°		<LIM		28
2120	Dibromochlorométhane	<		<		<		<LIM		2
12010	1,2-Dichlorobenzène	<		<		<		<LIM		2
12020	1,3-Dichlorobenzène	<		<		<		<LIM		2
12030	1,4-Dichlorobenzène	<		<		<		<LIM		2
2140	1,1-Dichloroéthane	<		<		<		<LIM		2
2150	1,2-Dichloroéthane	<		<		<		<LIM		2
2160	1,1-Dichloroéthylène	°°		°°		°°		<LIM		8
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		2
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		2
2130	Dichlorodifluorométhane	°°		°°		°°		<LIM		12
2180	1,2-Dichloropropane	<		<		<		<LIM		2
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		2
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		2
12060	1,2-Diméthylbenzène (o-xylène)	<		<		<		<LIM		2
12070	1,3-Diméthylbenzène (m-xylène)	<		<		<		<LIM		4
2200	Éthylbenzène	<		<		<		<LIM		2
2115	Éther éthylique	°°		°°		°°		<LIM		16
2245	Styrène	<		<		<		<LIM		2
2050	Tétrachlorure de carbone	<		<		<		<LIM		2
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		4
2161	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		2
2162	1,2,3,4-Tétraméthylbenzène	<		<		<		<LIM		2
2240	Toluène	<		<		<		<LIM		2
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		4
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		2
2270	Trichloroéthylène	<		<		<		<LIM		2
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		2
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		2
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		2
2243	Xylènes°°	<		<		<		<LIM		6
	Substances phénoliques	µg/l	g/d	µg/l	g/d	µg/l	g/d	µg/l	g/d	µg/l
	Phénol	°°		°°		°°		<LIM		2
	O-crésol	°°		°°		°°		<LIM		2
	M-crésol	°°		°°		°°		<LIM		2
	P-crésol	°°		°°		°°		<LIM		1
	2-Chlorophénol	<		<		<		<LIM		1
	3-Chlorophénol	<		<		<		<LIM		1
	4-Chlorophénol	<		<		<		<LIM		1
	2,4-Diméthylphénol	°°		°°		°°		<LIM		2
	Guaicol	<		<		<		<LIM		2
	2,6-Dichlorophénol	<		<		<		<LIM		1
	4-Chloro 3-méthylphénol	<		<		<		<LIM		1
	2,4+2,5-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		1
	Catéchol	<		<		<		<LIM		1
	2,3-Dichlorophénol	<		<		<		<LIM		1
	2-Nitrophénol	<		<		<		<LIM		1
	3,4-Dichlorophénol	<		<		<		<LIM		1
	4-Chloroguaiacol	<		<		<		<LIM		1
	2,4,6-Trichlorophénol	<		<		<		<LIM		1

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	JOURNÉE	*JOUR 1*	*JOUR 3*	*JOUR 5*		
	DATE	3/02/1997	5/02/1997	7/02/1997	MOYENNE ARITHMÉTIQUE	LDM
	HEURE	8 H 30	7 H 30	7 H 30		
	DÉBIT (m^3/j)	1213	1278	1256	1249,00	
CODE	**PARAMETRE**					
	4-Nitrophénol	<	<	<	<LIM	1
	2,3,6-Trichlorophénol	<	<	<	<LIM	1
	2,3,5-Trichlorophénol	<	<	<	<LIM	2
	2,4,5-Trichlorophénol	<	<	<	<LIM	1
	4,5-Dichlorovératrol	<	<	<	<LIM	1
	Eugénol	<	<	<	<LIM	3
	4-Chlorocatéchol	<	<	<	<LIM	1
	4,6-Dichloroguaiacol	<	<	<	<LIM	1
	2,3,4-Trichlorophénol	<	<	<	<LIM	1
	3,4,5-Trichlorophénol	<	<	<	<LIM	1
	4,5-Dichloroguaiacol	<	<	<	<LIM	1
	Isoeugénol	<	<	<	<LIM	2
	2,3,4,5-Tétrachlorophénol	<	<	<	<LIM	1
	3,5-Dichlorocatéchol	<	<	<	<LIM	1
	2,3,4,6-Tétrachlorophénol	<	<	<	<LIM	1
	3,4,5-Trichlorovératrol	<	<	<	<LIM	1
	6-Chlorovanilline	<	<	<	<LIM	1
	2,3,4,5-Tétrachlorophénol	<	<	<	<LIM	1
	4,5-Dichlorocatéchol	<	<	<	<LIM	1
	3,4,5-Trichloroguaiacol	<	<	<	<LIM	1
	Tétrachlorovératrol	<	<	<	<LIM	1
	4,5,6-Trichloroguaiacol	<	<	<	<LIM	1
	5,6-Dichlorovanilline	<	<	<	<LIM	1
	Pentachlorophénol	<	<	<	<LIM	1
	3,4,5-Trichlorocatéchol	<	<	<	<LIM	1
	Tétrachloroguaiacol	<	<	<	<LIM	1
	3,4,5-Trichlorosyringol	<	<	<	<LIM	1
	Tétrachlorocatéchol	<	<	<	<LIM	1

FARNHAM - HIVER 1997

		JOUR 1		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	1997/02/10-11		1997/02/12-13		1997/02/14-15				
	HEURE	10H00 À 10H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	12914		12750		13099		12921		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	1.41	18	0.94	12	1.80	24	1,38	18	0,03
700	Azote Kjeldahl total (N-NKT)	2.79	36	3.38	43	3.78	50	3,32	43	0,03
870	Carbone organique total (COT)	••		••		••		<LIM		0,15
640	Chlorures (Cl-)	59,2	765	115.0	1466	59.8	783	78,0	1005	0,06
634	Cyanates (CNO-)	<		<		0,41	5	<LIM		0,18
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	••		••		••		<LIM		6
	DBO5 carbonée	••		••		••		<LIM		5
820	Demande chimique en oxygène (DCO)	••		••		••		<LIM		9
650	Fluorures totaux (F-)	0,45	5.8	0,46	5.9	0,47	6,2	0,46	5,9	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	<		<		<		<LIM		0,09
110	Matières en suspension	4	52	16	204	14	183	11	146	3
181	Matières extractibles au fréon (Huiles et graisses totales)	1,00	12.9	1,40	17,9	1,40	18,3	1,27	16,4	0,06
	Nitrites (NO2)	0,450	5.8	0,070	0.9	0,070	0,9	0,197	2,5	0,006
	Nitrates (NO3)	0,68	8.8	0,09	1,1	0,06	0,8	0,28	3,6	0,03
680	Nitrites-nitrates (NO2-NO3)	1,130	14,6	0,160	2,0	0,130	1,7	0,473	6,1	0,003
674	Phosphore total (P tot.)	••		••		••		<LIM		0,05
135	Solides totaux (ST)	292	3771	427	5444	333	4362	351	4526	6
610	Sulfates (SO42-)	45,00	581	47,70	608	49,20	644	47,30	611	0,08
620	Sulfures totaux (S2-)	0,05	0,6	0,06	0,8	0,05	0,7	0,05	0,7	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	0,31	4,0	0,98	12,5	1,04	13,6	0,78	10,0	0,034
	Aluminium dissous	<		<		<		<LIM		0,04
410	Argent total	<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	(0,014)	(0,2)	(0,018)	(0,2)	(0,017)	(0,2)	(0,016)	(0,2)	0,0003
440	Cuivre total	0,033	0,4	0,047	0,6	0,063	0,8	0,048	0,6	0,001
460	Fer total	0,28	3,6	1,90	24,2	1,60	21,0	1,26	16,3	0,017
	Fer dissous	0,19	2,5	0,26	3,3	0,24	3,1	0,23	3,0	0,03
351	Mercure total	<		<		<		<LIM		0,0003
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	<		<		<		<LIM		0,0006
310	Sélénium total	<		<		<		<LIM		0,0003
330	Zinc total	0,07	0,9	0,06	0,8	<		0,04	0,6	0,0028
	Substances phénoliques	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
	Catéchol	<		<		<		<LIM		2
	4-Chlorocatéchol	<		<		<		<LIM		2
	4-Chloroguaiacol	<		<		<		<LIM		2
4020	2-Chlorophénol	<		<		<		<LIM		3
	3-Chlorophénol	<		<		<		<LIM		3
	4-Chlorophénol	<		<		<		<LIM		3
	6-Chlorovanilline	<		<		<		<LIM		3
	3,5-Dichlorocatéchol	<		<		<		<LIM		2
	4,5-Dichlorocatéchol	<		<		<		<LIM		1
	4,5-Dichloroguaiacol	<		<		<		<LIM		3
	4,6-Dichloroguaiacol	<		<		<		<LIM		3
	2,3-Dichlorophénol	<		<		<		<LIM		2
	2,4 + 2,5-Dichlorophénol	<		<		<		<LIM		4
	2,6-Dichlorophénol	<		<		<		<LIM		2
	3,4-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		2
	5,6-Dichlorovanilline	<		<		<		<LIM		2
	4,5-Dichlorovératrol	<		<		<		<LIM		3
	2,4-Diméthylphénol	<		<		<		<LIM		3
	Eugénol	<		<		<		<LIM		3
	Guaiacol	<		<		<		<LIM		1
	Isoeugénol	<		<		<		<LIM		2
	m-Crésol	<		<		<		<LIM		2
	o-Crésol	<		<		<		<LIM		3
	p-Crésol	<		<		<		<LIM		3
4060	2,4-Dinitrophénol	<		<		<		<LIM		2
4070	2-Nitrophénol	<		<		<		<LIM		1
4080	4-Nitrophénol	<		<		<		<LIM		2
4090	Pentachlorophénol	<		<		<		<LIM		2
4100	Phénol	<		<		<		<LIM		3
	Tétrachlorocatéchol	<		<		<		<LIM		2
	Tétrachloroguaiacol	<		<		<		<LIM		2
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,4,6-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,5,6-Tétrachlorophénol	<		<		<		<LIM		1
	3,4,5,6-Tétrachlorovératrol	<		<		<		<LIM		2
	3,4,5-Trichlorocatéchol	<		<		<		<LIM		3
	3,4,5-Trichloroguaiacol	<		<		<		<LIM		1
	4,5,6-Trichloroguaiacol	<		<		<		<LIM		2
	2,3,4-Trichlorophénol	<		<		<		<LIM		3
	2,3,5-Trichlorophénol	<		<		<		<LIM		2
	2,3,6-Trichlorophénol	<		<		<		<LIM		2
	2,4,5-Trichlorophénol	<		<		<		<LIM		2

FARNHAM - HIVER 1997

CODE	PARAMETRE	JOUR 1		JOUR 3		JOUR 5		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	1997/02/10-11		1997/02/12-13		1997/02/14-15				
	HEURE	10H00 À 10H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	12914		12750		13099		12921		
4110	2,4,6-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorosyringol	<		<		<		<LIM		2
	3,4,5-Trichlorovératrol	<		<		<		<LIM		1
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	••		••		••		<LIM		2,7
5020	Acrylonitrile	••		••		••		<LIM		2,5
2010	Benzène	0,40	5	<		<		<LIM		0,40
2020	Bromodichlorométhane	<		<		<		<LIM		0,50
2030	Bromoforme	<		<		<		<LIM		0,70
2040	Bromométhane	<		<		<		<LIM		1,15
2202	n-Butylbenzène	<		<		<		<LIM		0,50
2203	tert-Butylbenzène	<		<		<		<LIM		0,40
2060	Chlorobenzène	<		<		<		<LIM		0,40
2211	Chlorure de benzyle	<		<		<		<LIM		0,70
2070	Chloroéthane	<		<		<		<LIM		1,5
	Chloroéthylène	<		<		<		<LIM		0,90
2080	2-Chloroéthylvinyl éther	<		<		<		<LIM		0,90
2100	Chlorométhane	<		<		<		<LIM		1,1
2080	bis-Chlorométhyl éther	••		••		••		<LIM		1,0
2120	Dibromochlorométhane	<		<		<		<LIM		0,50
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,50
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,40
12030	1,4-Dichlorobenzène	<		<		<		<LIM		0,50
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,40
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,20
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,70
2400	cis-1,2-Dichloroéthylène	••		••		••		<LIM		0,30
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,70
2130	Dichlorodifluorométhane	<		<		<		<LIM		1,0
2180	1,2-Dichloropropane	<		<		<		<LIM		0,40
	cis-1,3-Dichloropropène	<		<		<		<LIM		0,40
	trans-1,3-Dichloropropène	<		<		<		<LIM		0,20
2200	Éthylbenzène	<		<		<		<LIM		0,40
2115	Éther éthylique	<		<		<		<LIM		0,50
	o-xylène	<		0,50	6	<		<LIM		0,40
	p,m-xylènes	<		<		<		<LIM		0,40
2245	Styrène	<		<		<		<LIM		0,30
2050	Tétrachlorure de carbone	••		••		••		<LIM		0,60
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		0,60
	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		0,40
2162	1,2,3,4-Tétraméthylbenzène	••		••		••		<LIM		0,70
2240	Toluène	••		••		••		<LIM		0,20
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,50
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,30
2270	Trichloroéthylène	<		<		<		<LIM		0,50
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		1,1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		0,60
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		0,40

JONQUIÈRE - HIVER 1997

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1997/01/20-21		1997/01/22-23		1997/01/24-25		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8 H 00 À 8 H 00		8 H 00 À 8 H 00		8 H 00 À 8 H 00				
	DÉBIT (m^3/j)	35854		33967		34277		34699,33		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	2.4	86	2.2	75	2.2	75	2,3	79	0,1
700	Azote Kjeldahl total (N-NKT)	3.2	115	3.2	109	2.8	96	3,1	106	0,2
870	Carbone organique total (COT)	(9.9)	(355.0)	(9.5)	(322.7)	(10.0)	(342.8)	(9,8)	(340,1)	0,2
640	Chlorures (Cl-)	41	1470	41	1393	43	1474	42	1446	0,05
634	Cyanates (CNO-)	0.1	3.6	0.2	6.8	0,1	3.4	0,1	4.6	0.1
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0.01
840	Demande biochimique en oxygène (DBO5)	6	215	3	102	3	103	4	140	2
	Demande biochimique en oxygène carbonée (DBO5)	7	251	5	170	<		4	140	3
820	Demande chimique en oxygène (DCO)	29	1040	32	1087	24	823	28	983	5
650	Fluorures totaux (F-)	0.09	3.2	0.08	2.7	0.07	2.4	0.08	2.8	0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	0.4	14	0.2	7	0.3	10	0,3	10	0,1
110	Matières en suspension	5	179	4	136	4	137	4	151	4
181	Matières extractibles au fréon (Huiles et graisses totales)	0.7	25	0.3	10	1.1	38	0,7	24	0,1
680	Nitrites-nitrates (NO2-NO3)	4.0	143	3,1	105	3,5	120	3,5	123	0,01
674	Phosphore total (P tot.)	0,37	13	0.28	10	0.27	9	0.31	11	0,06
135	Solides totaux (ST)	210	7529	190	6454	110	3770	170	5918	10
610	Sulfates (SO42-)	34	1219	27	917	37	1268	33	1135	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	0.3	10.76	0.2	6.79	0.2	6.86	0,2	8,14	0,1
	Aluminium dissous	0.1	3.59	0.1	3.40	<		<LIM		0,1
410	Argent total	<		0,001	0.034	0.001	0,034	<LIM		0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	0,001	0.036	0.002	0.0679	0.001	0.034	0.001	0.046	0,001
440	Cuivre total	0.009	0.323	0.009	0.306	0.010	0.343	0.009	0,324	0,001
460	Fer total	0.08	2.87	0.06	2.04	0.07	2.40	0.07	2.44	0.02
	Fer dissous	<		0.02	0.68	<		<LIM		0.02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0.01
301	Plomb total	0,0008	0.0287	0,0026	0.0883	0.0015	0.0514	0.0016	0,0561	0,0005
310	Sélénium total	<		<		<		<LIM		0,001
330	Zinc total	0,01	0.36	0,02	0.68	0,02	0,69	0.02	0.57	0.01

LA PRAIRIE - HIVER 1996

CODE	PARAMETRE	JOUR 1		JOUR 3		JOUR 5		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	1996/12/02-03		1996/12/04-05		1996/12/06-07				
	HEURE	10H00 À 10H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	50333		48990		45356		48226		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	1,21	61	2,95	145	7,45	338	3,87	181	0,03
700	Azote Kjeldahl total (N-NKT)	2.45	123	4.08	200	9.45	429	5,33	251	0,03
870	Carbone organique total (COT)	**		**		**		<LIM		0,15
640	Chlorures (Cl-)	149	7500	149	7300	158	7166	152	7322	0,06
634	Cyanates (CNO-)	0,66	33	0,59	29	2,30	104	1,18	55	0,18
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	**		**		**		<LIM		6
	DBO5 carbonée	**		**		**		<LIM		5
820	Demande chimique en oxygène (DCO)	**		**		**		<LIM		9
650	Fluorures totaux (F-)	0,25	13	0,27	13	0,30	14	0,27	13	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	<		0,31	15,2	<		0,10	5,1	0,09
110	Matières en suspension	13	654	19	931	112	5080	48	2222	3
181	Matières extractibles au fréon (Huiles et graisses totales)	<		0,74	36	1,02	46	0,59	28	0,06
	Nitrites (NO2)	0,070	3,5	0,040	2,0	<		0,037	1,8	0,006
	Nitrates (NO3)	2,80	141	0,60	29	0,09	4	1,16	58	0,03
680	Nitrites-nitrates (NO2-NO3)	2,880	145	0,640	31	0,090	4	1,203	60	0,003
674	Phosphore total (P tot.)	**		**		**		<LIM		0,05
135	Solides totaux (ST)	686	34528	783	38359	850	38553	773	37147	6
610	Sulfates (SO42-)	(165)	(8305)	(169)	(8279)	(176)	(7983)	(170)	(8189)	0,08
620	Sulfures totaux (S2-)	0,02	1,0	0,04	2,0	0,06	2,7	0,04	1,9	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	0,11	5,54	0,05	2,45	0,10	4,54	0,09	4,17	0,034
	Aluminium dissous	0,10	5,03	0,06	2,94	0,08	3,63	0,08	3,87	0,04
410	Argent total	<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	0,027	1,36	0,028	1,3717	0,028	1,2700	0,028	1,33	0,0003
440	Cuivre total	0,008	0,40	0,004	0,20	0,003	0,14	0,005	0,24	0,001
460	Fer total	<		<		<		<LIM		0,018
	Fer dissous	<		<		<		<LIM		0,018
351	Mercure total	<		<		<		<LIM		0,0003
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	<		<		<		<LIM		0,0008
310	Sélénium total	<		<		<		<LIM		0,0002
330	Zinc total	<		<		<		<LIM		0,0028
	Substances phénoliques	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
	Catéchol	<		<		<		<LIM		2
	4-Chlorocatéchol	<		<		<		<LIM		2
	4-Chloroguaiacol	<		<		<		<LIM		2
4020	2-Chlorophénol	**		**		**		<LIM		3
	3-Chlorophénol	<		<		<		<LIM		3
	4-Chlorophénol	<		<		<		<LIM		3
	6-Chlorovanilline	<		<		<		<LIM		3
	3,5-Dichlorocatechol	<		<		<		<LIM		2
	4,5-Dichlorocatéchol	<		<		<		<LIM		1
	4,5-Dichloroguaiacol	<		<		<		<LIM		3
	4,6-Dichloroguaiacol	<		<		<		<LIM		3
	2,3-Dichlorophénol	<		<		<		<LIM		2
	2,4 + 2,5-Dichlorophénol	<		<		<		<LIM		4
	2,6-Dichlorophénol	<		<		<		<LIM		2
	3,4-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		2
	5,6-Dichlorovanilline	<		<		<		<LIM		2
	4,5-Dichlorovératrol	<		<		<		<LIM		3
	2,4-Diméthylphénol	<		<		<		<LIM		3
	Eugénol	<		<		<		<LIM		3
	Guaiacol	<		<		<		<LIM		1
	Isoeugénol	<		<		<		<LIM		2
	m-Crésol	<		<		<		<LIM		2
	o-Crésol	<		<		<		<LIM		3
	p-Crésol	<		<		<		<LIM		3
4060	2,4-Dinitrophénol	<		<		<		<LIM		2
4070	2-Nitrophénol	<		<		<		<LIM		1
4080	4-Nitrophénol	<		<		<		<LIM		2
4090	Pentachlorophénol	<		<		<		<LIM		2
4100	Phénol	<		<		<		<LIM		3
	Tétrachlorocatéchol	<		<		<		<LIM		2
	Tétrachloroguaiacol	<		<		<		<LIM		2
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,4,6-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,5,6-Tétrachlorophénol	<		<		<		<LIM		1
	3,4,5,6-Tétrachlorovératrol	<		<		<		<LIM		2
	3,4,5-Trichlorocatéchol	<		<		<		<LIM		3
	3,4,5-Trichloroguaiacol	<		<		<		<LIM		1
	4,5,6-Trichloroguaiacol	<		<		<		<LIM		2
	2,3,4-Trichlorophénol	<		<		<		<LIM		3
	2,3,5-Trichlorophénol	<		<		<		<LIM		2
	2,3,6-Trichlorophénol	<		<		<		<LIM		2
	2,4,5-Trichlorophénol	<		<		<		<LIM		2

LA PRAIRIE - HIVER 1996

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1996/12/02-03		1996/12/04-05		1996/12/06-07		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	10H00 À 10H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	50333		48990		45356		48226		
CODE	**PARAMETRE**									
4110	2,4,6-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorosyringol	**		**		**		<LIM		2
	3,4,5-Trichlorovératrol	<		<		<		<LIM		1
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	**		**		**		<LIM		2,70
5020	Acrylonitrile	**		**		**		<LIM		2,50
2010	Benzène	<		<		<		<LIM		0,40
2020	Bromodichlorométhane	<		<		<		<LIM		0,50
2030	Bromoforme	<		<		<		<LIM		0,70
2040	Bromométhane	<		<		<		<LIM		1,15
2202	n-Butylbenzène	<		<		<		<LIM		0,50
2203	tert-Butylbenzène	<		<		<		<LIM		0,40
2060	Chlorobenzène	<		<		<		<LIM		0,40
2211	Chlorure de benzyle	<		<		<		<LIM		0,70
2070	Chloroéthane	<		<		<		<LIM		1,50
	Chloroéthylène	<		<		<		<LIM		0,90
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		0,90
2100	Chlorométhane	<		<		<		<LIM		1,10
2080	bis-Chlorométhyl éther	**		**		**		<LIM		1,00
2120	Dibromochlorométhane	<		<		<		<LIM		0,50
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,50
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,40
12030	1,4-Dichlorobenzène	<		<		<		<LIM		0,50
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,40
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,20
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,70
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		0,30
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,70
2130	Dichlorodifluorométhane	<		<		<		<LIM		1,00
2180	1,2-Dichloropropane	<		<		<		<LIM		0,40
	cis-1,3-Dichloropropène	<		<		<		<LIM		0,40
	trans-1,3-Dichloropropène	<		<		<		<LIM		0,20
2200	Éthylbenzène	<		<		<		<LIM		0,40
2115	Éther éthylique	<		1,80	88,18	1,40	63,50	1,07	50,56	0,50
	o-xylène	<		<		<		<LIM		0,40
	p,m-xylènes	<		<		<		<LIM		0,40
2245	Styrène	<		<		<		<LIM		0,30
2050	Tétrachlorure de carbone	**		**		**		<LIM		0,60
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		0,60
	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		0,40
2162	1,2,3,4-Tétraméthylbenzène	**		**		**		<LIM		0,70
2240	Toluène	<		<		<		<LIM		0,20
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,50
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,30
2270	Trichloroéthylène	<		<		<		<LIM		0,50
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		1,10
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		0,60
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		0,40

LONGUEUIL (CERS) - HIVER 1996

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1996/12/09-10		1996/12/11-12		1996/12/13-14		MOYENNE ARITHMÉTIQUE		LDM
	HEURE	11H15 À 11H15		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m^3/j)	321000		296000		324000		313667		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	8.12	2607	10,60	3138	10,70	3467	9,81	3070	0,03
700	Azote Kjeldahl total (N-NKT)	11.30	3627	12,10	3582	11,80	3823	11,73	3677	0,03
870	Carbone organique total (COT)	••		••		••		<LIM		0,15
640	Chlorures (Cl-)	119	38199	114	33744	120	38880	118	36941	0,06
634	Cyanates (CNO-)	1.57	504	0,55	163	<0,18		0,71	222	0,18
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	••		[illegible]		••		<LIM		6
	DBO5 carbonée	••		••		••		<LIM		5
820	Demande chimique en oxygène (DCO)	••		••		••		<LIM		9
650	Fluorures totaux (F-)	0.16	51	0,17	50	0,15	49	0,16	50	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	0,24	77	0,19	56	<0,1		0,14	44	0,09
110	Matières en suspension	18	5778	12	3552	57	18468	29	9266	3
181	Matières extractibles au fréon (Huiles et graisses totales)	(2,04)	(655)	(2,29)	(678)	(1,95)	(632)	(2,09)	(655)	0,06
680	Nitrites-nitrates (NO2-NO3)	0.430	138	0,034	10	0,029	9	0,164	52	0,003
674	Phosphore total (P tot.)	••		••		••		<LIM		0,05
135	Solides totaux (ST)	584	187464	650	192400	608	196992	614	192285	6
610	Sulfates (SO42-)	149,00	47829	144,00	42624	220,00	71280	171,00	53911	0,08
620	Sulfures totaux (S2-)	0,04	13	0,06	18	0,06	19	0,05	17	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	0,89	286	1,06	314	0,85	275	0,93	292	0,034
600	Aluminium dissous	0,14	45	0,18	53	0,61	198	0,31	99	0,04
410	Argent total	<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	0,034	11	0,027	8	0,018	6	0,026	8	0,0003
440	Cuivre total	0,012	4	0,015	4	0,009	3	0,012	4	0,001
460	Fer total	0.16	51	0,17	50	0.16	52	0,16	51	0,017
	Fer dissous	<		<		0.130	42	0,043	14	0,018
351	Mercure total	<		<		<		<LIM		0,0002
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	<		<		<		<LIM		0,0008
310	Sélénium total	<		<		<		<LIM		0,0002
330	Zinc total	<		<		<		<LIM		0,0028
	Substances phénoliques	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
	Catéchol	<		<		<		<LIM		2
	4-Chlorocatéchol	<		<		<		<LIM		2
	4-Chloroguaiacol	<		<		<		<LIM		2
4020	2-Chlorophénol	<		<		<		<LIM		3
	3-Chlorophénol	<		<		<		<LIM		2
	4-Chlorophénol	<		<		<		<LIM		2
	6-Chlorovanilline	••		••		••		<LIM		2
	3,5-Dichlorocatéchol	<		<		<		<LIM		2
	4,5-Dichlorocatéchol	<		<		<		<LIM		2
	4,5-Dichloroguaiacol	<		<		<		<LIM		1
	4,6-Dichloroguaiacol	<		<		<		<LIM		3
	2,3-Dichlorophénol	<		<		<		<LIM		2
	2,4 + 2,5-Dichlorophénol	<		<		<		<LIM		2
	2,6-Dichlorophénol	<		<		<		<LIM		2
	3,4-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		2
	5,6-Dichlorovanilline	<		<		<		<LIM		2
	4,5-Dichlorovératrol	<		<		<		<LIM		3
	2,4-Diméthylphénol	<		<		<		<LIM		4
	Eugénol	<		<		<		<LIM		2
	Guaiacol	<		<		<		<LIM		3
	Isoeugénol	••		••		••		<LIM		1
	m-Crésol	<		<		<		<LIM		2
	o-Crésol	<		<		<		<LIM		2
	p-Crésol	<		<		<		<LIM		3
4060	2,4-Dinitrophénol	<		<		<		<LIM		3
4070	2-Nitrophénol	<		<		<		<LIM		1
4080	4-Nitrophénol	<		<		<		<LIM		3
4090	Pentachlorophénol	<		<		<		<LIM		3
4100	Phénol	<		<		<		<LIM		2
	Tétrachlorocatéchol	<		<		<		<LIM		3
	Tétrachloroguaiacol	<		<		<		<LIM		2
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,4,6-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,5,6-Tétrachlorophénol	<		<		<		<LIM		2
	3,4,5,6-Tétrachlorovératrol	<		<		<		<LIM		1
	3,4,5-Trichlorocatéchol	<		<		<		<LIM		3
	3,4,5-Trichloroguaiacol	<		<		<		<LIM		3
	4,5,6-Trichloroguaiacol	<		<		<		<LIM		3
	2,3,4-Trichlorophénol	<		<		<		<LIM		3
	2,3,5-Trichlorophénol	<		<		<		<LIM		3
	2,3,6-Trichlorophénol	<		<		<		<LIM		1
	2,4,5-Trichlorophénol	<		<		<		<LIM		2
4110	2,4,6-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorophénol	<		<		<		<LIM		1

LONGUEUIL (CERS) - HIVER 1996

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1996/12/09-10		1996/12/11-12		1996/12/13-14		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	11H15 À 11H15		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m³/j)	321000		296000		324000		313667		
CODE	**PARAMETRE**									
	3,4,5-Trichlorosyringol	<		<		<		<LIM		2
	3,4,5-Trichlorovératrol	<		<		<		<LIM		2
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	**		**		**		<LIM		2,70
5020	Acrylonitrile	**		**		**		<LIM		2,50
2010	Benzène	<		<		<		<LIM		0,40
2020	Bromodichlorométhane	1.00	321	0,60	178	0,80	259	0,80	253	0,50
2030	Bromoforme	<		<		<		<LIM		0,70
2040	Bromométhane	**		**		**		<LIM		1,15
2202	n-Butylbenzène	<		<		<		<LIM		0,50
2203	tert-Butylbenzène	<		<		<		<LIM		0,40
2060	Chlorobenzène	<		<		<		<LIM		0,40
2211	Chlorure de benzyle	**		**		**		<LIM		0,70
2070	Chloroéthane	**		**		**		<LIM		1,50
	Chloroéthylène	<		<		<		<LIM		0,90
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		0,90
2100	Chlorométhane	**		**		**		<LIM		1,10
2080	bis-Chlorométhyl éther	**		**		**		<LIM		1,00
2120	Dibromochlorométhane	<		<		<		<LIM		0,50
12010	1,2-Dichlorobenzène	0,60	193	0,60	178	<		<LIM		0,50
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,40
12030	1,4-Dichlorobenzène	<		<		<		<LIM		0,50
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,40
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,20
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,70
2400	cis-1,2-Dichloroéthylène	0,50	161	<		<		<LIM		0,30
2170	trans-1,2-Dichloroéthylène	**		**		**		<LIM		0,70
2130	Dichlorodifluorométhane	**		**		**		<LIM		1,00
2180	1,2-Dichloropropane	<		<		<		<LIM		0,40
	cis-1,3-Dichloropropène	<		<		<		<LIM		0,40
	trans-1,3-Dichloropropène	0,20	64	<		<		<LIM		0,20
2200	Éthylbenzène	0,70	225	19,00	5624	2,70	875	7,47	2241	0,40
2115	Éther éthylique	**		**		**		<LIM		0,50
	o-xylène	<		9,80	2901	1,40	454	3,73	1118	0,40
	p,m-xylènes	0,50	161	4,10	1214	0,90	292	1,83	555	0,40
2245	Styrène	<		0,50	148	1,00	324	0,50	157	0,30
2050	Tétrachlorure de carbone	**		**		**		<LIM		0,60
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		0,60
	1,1,2,2-Tétrachloroéthylène	1,00	321	0,90	266	0,40	130	0,77	239	0,40
2162	1,2,3,4-Tétraméthylbenzène	**		**		**		<LIM		0,70
2240	Toluène	0,60	193	1,10	326	0,50	162	0,73	227	0,20
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,50
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,30
2270	Trichloroéthylène	<		<		<		<LIM		0,50
2163	1,2,3-Triméthylbenzène	**		**		**		<LIM		1,10
2164	1,2,4-Triméthylbenzène	10,00	3210	1,90	562	<		3,97	1257	0,60
2165	1,3,5-Triméthylbenzène	2,70	867	0,50	148	<		1,07	338	0,40

MAGOG - HIVER 1997

CODE	PARAMETRE	JOUR 1		JOUR 3		JOUR 5		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	1997/01/13-14		1997/01/15-16		1997/01/17-18				
	HEURE	08H00 À 08H00		08H00 À 08H00		08H00 À 08H00				
	DÉBIT (m3/j)	12868		12595		12052		12505		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	0,19	2,4	0,24	3,0	0,06	0,7	0,16	2,1	0,03
700	Azote Kjeldahl total (N-NKT)	0,99	13	1,00	13	0,90	11	0,96	12	0,03
870	Carbone organique total (COT)	**		**		**		<LIM		0,15
640	Chlorures (Cl-)	97,9	1260	134,0	1688	158,0	1904	130,0	1617	0,06
634	Cyanates (CNO-)	<		0,28	4	<		<LIM		0,18
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,03
840	Demande biochimique en oxygène (DBO5)	**		**		**		<LIM		6
	DBO5 carbonée	**		**		**		<LIM		5
820	Demande chimique en oxygène (DCO)	**		**		**		<LIM		9
650	Fluorures totaux (F-)	0,11	1,4	0,13	1,6	0,13	1,6	0,12	1,5	0,01
182	Hydrocarbures totaux (Huiles et graisses minérales)	<		<		<		<LIM		0,09
110	Matières en suspension	<		4	50	8	96	4	49	3
181	Matières extractibles au fréon (Huiles et graisses totales)	<		0,25	3	0,28	3	0,18	2	0,06
	Nitrites (NO2)	0,047	0,6	0,125	1,6	<		0,057	0,7	0,006
	Nitrates (NO3)	7,67	99	6,38	80	5,80	70	6,62	83	0,03
680	Nitrites-nitrates (NO2-NO3)	7,720	99	6,510	82	5,800	70	6,677	84	0,003
674	Phosphore total (P tot.)	**		**		**		<LIM		0,05
135	Solides totaux (ST)	305	3925	350	4408	371	4471	342	4268	6
610	Sulfates (SO42-)	73,40	945	71,10	896	74,20	894	72,90	911	0,08
620	Sulfures totaux (S2-)	0,09	1,2	0,05	0,6	0,07	0,8	0,07	0,9	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
602	Aluminium	0,35	4,50	0,34	4,28	0,37	4,46	0,35	4,42	0,034
	Aluminium dissous	0,34	4,38	0,30	3,78	0,31	3,74	0,32	3,96	0,04
410	Argent total	<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<LIM		0,001
451	Chrome total	(0,018)	(0,23)	(0,013)	(0,16)	(0,013)	(0,16)	(0,015)	(0,18)	0,0003
440	Cuivre total	(0,021)	(0,27)	(0,024)	(0,30)	(0,022)	(0,27)	(0,022)	(0,28)	0,001
460	Fer total	1,20	15,44	1,10	13,85	1,20	14,46	1,17	14,59	0,017
	Fer disscus	0,24	3,09	0,10	1,26	0,09	1,08	0,14	1,81	0,03
351	Mercure total	0,0009	0,01	<		<		0,0003	0,00	0,0003
430	Nickel total	<		<		<		<LIM		0,0056
301	Plomb total	<		<		<		<LIM		0,0006
310	Sélénium total	<		<		<		<LIM		0,0003
330	Zinc total	0,29	3,73	0,06	0,76	0,07	0,84	0,14	1,78	0,0028
	Substances phénoliques	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
	Catéchol	<		<		<		<LIM		2
	4-Chlorocatéchol	<		<		<		<LIM		2
	4-Chloroguaiacol	**		**		**		<LIM		2
4020	2-Chlorophénol	<		<		<		<LIM		3
	3-Chlorophénol	<		<		<		<LIM		3
	4-Chlorophénol	<		<		<		<LIM		3
	6-Chlorovanilline	**		**		**		<LIM		3
	3,5-Dichlorocatéchol	<		<		<		<LIM		2
	4,5-Dichlorocatéchol	<		<		<		<LIM		1
	4,5-Dichloroguaiacol	<		<		<		<LIM		3
	4,6-Dichloroguaiacol	<		<		<		<LIM		3
	2,3-Dichlorophénol	**		**		**		<LIM		2
	2,4 + 2,5-Dichlorophénol	<		<		<		<LIM		4
	2,6-Dichlorophénol	<		<		<		<LIM		2
	3,4-Dichlorophénol	<		<		<		<LIM		3
	3,5-Dichlorophénol	<		<		<		<LIM		2
	5,6-Dichlorovanilline	<		<		<		<LIM		2
	4,5-Dichlorovératrol	<		<		<		<LIM		3
	2,4-Diméthylphénol	**		**		**		<LIM		3
	Eugénol	<		<		<		<LIM		3
	Guaiacol	**		**		**		<LIM		1
	Isoeugénol	<		<		<		<LIM		2
	m-Crésol	<		<		<		<LIM		2
	o-Crésol	<		<		<		<LIM		3
	p-Crésol	**		**		**		<LIM		3
4060	2,4-Dinitrophénol	<		<		<		<LIM		2
4070	2-Nitrophénol	<		<		<		<LIM		1
4080	4-Nitrophénol	<		<		<		<LIM		2
4090	Pentachlorophénol	<		<		<		<LIM		2
4100	Phénol	<		<		<		<LIM		3
	Tétrachlorocatéchol	<		<		<		<LIM		2
	Tétrachloroguaiacol	<		<		<		<LIM		2
	2,3,4,5-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,4,6-Tétrachlorophénol	<		<		<		<LIM		3
	2,3,5,6-Tétrachlorophénol	<		<		<		<LIM		1
	3,4,5,6-Tétrachlorovératrol	<		<		<		<LIM		2
	3,4,5-Trichlorocatéchol	<		<		<		<LIM		3
	3,4,5-Trichloroguaiacol	<		<		<		<LIM		1
	4,5,6-Trichloroguaiacol	<		<		<		<LIM		2
	2,3,4-Trichlorophénol	<		<		<		<LIM		3
	2,3,5-Trichlorophénol	<		<		<		<LIM		2
	2,3,6-Trichlorophénol	<		<		<		<LIM		2
	2,4,5-Trichlorophénol	<		<		<		<LIM		2

MAGOG - HIVER 1997

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	1997/01/13-14		1997/01/15-16		1997/01/17-18		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	08H00 À 08H00		08H00 À 08H00		08H00 À 08H00				
	DEBIT (m3/j)	12868		12595		12052		12505		
CODE	**PARAMETRE**									
4110	2,4,6-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorophénol	<		<		<		<LIM		2
	3,4,5-Trichlorosyringol	<		<		<		<LIM		2
	3,4,5-Trichlorovératrol	<		<		<		<LIM		1

MARTINVILLE - HIVER 1999

CODE	PARAMÈTRE	JOUR 1		JOUR 3		JOUR 5				
	JOUR - DATE	31/05/99		2/06/99		4/06/99		MOYENNE ARITHMÉTIQUE		LDM
	DÉBIT (m3/j)	1821.4		1559		1461.2		1614		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	6,6	12,0	3,9	6,1	0,7	1,0	3,7	6,4	0,01
700	Azote Kjeldahl total (N-NKT)	8,1	14,8	5,3	8,3	2,6	3,8	5,3	8,9	0,1
640	Chlorures (Cl-)	32	58	32	50	31	45	32	51	0,1
631	Cyanures totaux (CN- tot)	<		<		<		<LIM		0,003
	Conductivité (µmhos/cm)	469		441		400		437		
840	Demande biochimique en oxygène (DBO5)	26	47	23	36	19	28	23	37	2
	Demande biochimique en oxygène carbonatée	25	46	23	36	19	28	22	36	3
820	Demande chimique en oxygène (DCO)	46	84	61	95	33	48	47	76	3
	Dureté totale (titrage) (mgCaCO3/L)	129	235	123	192	115	168	122	198	1
650	Fluorures totaux (F-)	0,03	0,05	0,06	0,09	0,03	0,04	0,04	0,06	0,004
182	Hydrocarbures pétroliers (C10-C50)	0,1	0,2	<		<		<LIM		0,1
110	Matières en suspension	20	36	16	25	17	25	18	29	2
680	Nitrites-nitrates (NO2-NO3)	<		0,02	0,03	<		<LIM		0,01
	Nitrates (Calcul)	<		0,015	0,02	<		<LIM		0,01
	Nitrites (colorimétrie)	0,005	0,009	0,005	0,008	0,009	0,013	0,006	0	0,0008
	Oxygène dissous	6,3		7,1		6,4		6,6		
	Phénols (colorimétrie)	0,006	0,01	0,008	0,01	0,004	0,01	0,006	0,01	0,002
674	Phosphore total (P tot)	1,8	3,3	1,2	1,9	0,7	1,0	1,2	2,1	0,02
610	Sulfates (turbidimétrie) (SO42-)	13	24	20	31	29	42	21	32	1
	Sulfures dissous	0,13	0,2	0,12	0,2	0,11	0,2	0,12	0,2	0,01
620	Sulfures totaux (S2-)	0,97	1,8	0,52	0,8	0,18	0,3	0,56	0,9	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,220	0,4	0,140	0,2	0,400	0,6	0,253	0,4	0,002
	Antimoine	<		<		<		<LIM		0,0001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	0,0019	0,003	0,0016	0,002	0,0020	0,003	0,0018	0,003	0,0001
	Baryum	0,0068	0,01	0,0056	0,01	0,0046	0,01	0,0057	0,01	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,067	0,1	0,023	0,04	0,024	0,04	0,038	0,1	0,002
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,0003	0,001	0,0007	0,001	0,0019	0,003	0,0010	0,001	0,0001
	Cobalt	0,0005	0,001	0,0004	0,001	0,0004	0,001	0,0004	0,001	0,0002
	Cuivre	0,003	0,01	0,003	0,005	0,002	0,003	0,003	0,004	0,001
	Fer	0,240	0,4	0,190	0,3	0,150	0,2	0,193	0,3	0,02
	Mercure	2,1E-05	3,8E-05	2,4E-05	3,7E-05	3,4E-05	5,0E-05	2,6,E-05	4,2E-05	6,E-06
	Molybdène	<		<		<		<LIM		0,001
	Nickel	0,003	0,01	0,003	0,005	0,001	0,001	0,002	0,004	0,001
	Plomb	0,0001	0,0002	<		<		<LIM		0,0001
	Sélénium	0,0005	0,001	0,0001	0,0002	0,0002	0,0003	0,0003	0,0005	0,0001
	Vanadium	0,0005	0,001	0,0006	0,001	0,0008	0,001	0,0006	0,001	0,0002
	Zinc	0,003	0,01	0,003	0,005	0,002	0,003	0,003	0,004	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0,3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	<		<		<		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	<		<		<		<LIM		4
2080	2-Chloroéthylvinyl ether	<		<		<		<LIM		6
2100	Chlorométhane	**		**		**		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	**		**		**		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0,5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	**		**		**		<LIM		1
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		1
2170	trans-1,2-Dichloroéthylène	**		**		**		<LIM		1
2130	Dichlorodifluorométhane	**		**		**		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	**		**		**		<LIM		1
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	**		**		**		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	**		**		**		<LIM		2
2161	Tétrachloroéthylène	<		<		<		<LIM		1
2240	Toluène	9,9	18,0	6,6	10,3	<		5,5	9,4	1
2250	1,1,1-Trichloroéthane	**		**		**		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1

MARTINVILLE - HIVER 1999

CODE	PARAMÈTRE	*JOUR 1*		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	31/05/99		2/06/99		4/06/99				
	DEBIT (m3/j)	1821,4		1559		1461,2		1614		
CODE	**PARAMÈTRE**									
2270	Trichloroéthylène	<		<		<		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracene	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	<		<		<		<LIM		0,2
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,3
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,4
2030	1,4-Dichlorobenzène	<		<		<		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<		<LIM		0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	<		<		<		<LIM		0,5
14030	Diéthylphtalate	<		<		<		<LIM		0,4
14040	Diméthylphtalate	<		<		<		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	<		<		<		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	<		<		<		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	<		<		<		<LIM		0,3
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	<		<		<		<LIM		0,4
16090	Hexachloroéthane	<		<		<		<LIM		0,4

SAINT-GÉDÉON - HIVER 1997

CODE	PARAMETRE									
	JOURNÉE	*JOUR 1*		*JOUR 3*		*JOUR 5*				
	DATE	20/01/1997		22/01/1997		24/01/1997		MOYENNE ARITHMETIQUE		LDM
	HEURE	16 H 15		16 H 00		15 H 30				
	DÉBIT (m^3/j)	478		460		426		454,67		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	9.6	4.6	10.2	4.7	10.4	4,4	10.1	4,6	0.1
700	Azote Kjeldahl total (N-NKT)	10.9	5.2	11.7	5.4	12,6	5.4	11.7	5,3	0,2
870	Carbone organique total (COT)	(19.3)	(9.23)	(20.0)	(9,20)	(22.8)	(9.71)	(20.7)	(9,38)	0,2
640	Chlorures (Cl-)	97	46.4	93	42,8	95	40.5	95	43.2	0,2
634	Cyanates (CNO-)	0.3	0.1	0.6	0.3	0.7	0.3	0.5	0.2	0,1
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,01
840	Demande biochimique en oxygène (DBO5)	6	2.9	7	3.2	8	3.4	7	3,2	2
	Demande biochimique en oxygène carbonée (DBO5)	6	2.9	7	3,2	5	2.1	6	2.7	3
820	Demande chimique en oxygène (DCO)	52	24.9	47	21,6	58	24.7	52	23,7	5
650	Fluorures totaux (F-)	0.12	0.1	0.12	0,1	0.11	0,0	0,12	0.1	0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	0.4	0.2	0,3	0.1	0.3	0.1	0.3	0,2	0,1
110	Matières en suspension	<		7	3.2	8	3.4	5	2.2	4
181	Matières extractibles au fréon (Huiles et graisses totales)	1.2	0.6	1,0	0.5	1,4	0.6	1.2	0.5	0,1
680	Nitrites-nitrates (NO2-NO3)	1.2	0.6	1,2	0,6	1.1	0.5	1.2	0.5	0,01
674	Phosphore total (P tot.)	1,73	0.8	1.80	0.8	1.72	0,7	1.75	0.8	0,06
135	Solides totaux (ST)	370	176.9	340	156.4	440	187,4	383	173.6	10
610	Sulfates (SO42-)	25	12.0	25	11.5	30	12.8	27	12.1	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	<		0.3	0.14	<		0.1	0,05	0.1
	Aluminium dissous	0.1	0.05	<		<		<LIM		0.1
410	Argent total	0.003	0.001	0.003	0.001	0.004	0.002	0.003	0,002	0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	0.004	0.002	0.001	0.0005	0.002	0.001	0,002	0,001	0,001
440	Cuivre total	0.017	0.008	0.016	0.007	0.017	0.007	0.017	0,008	0,001
460	Fer total	0.27	0.13	0.28	0.13	0.29	0.12	0.28	0.13	0.02
	Fer dissous	0.17	0.08	0.19	0.09	0.21	0,09	0.19	0,09	0.02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0.01
301	Plomb total	<		<		<		<LIM		0.0005
310	Sélénium total	<		<		<		<LIM		0,001
330	Zinc total	<		<		<		<LIM		0.01

SAINT-JOSEPH-DE-BEAUCE - HIVER 1997

	JOURNEE	*JOUR 1*		*JOUR 3*		*JOUR 5*				
	DATE	27/01/1997		29/01/1997		31/01/1997		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	9 H 15		9 H 00		8 H 30				
	DÉBIT (m^3/j)	3725		3364		3024		3371		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	24	89	25	84	26	79	25	84	0,1
700	Azote Kjeldahl total (N-NKT)	26	97	26	87	27	82	26	89	0,2
870	Carbone organique total (COT)	29	108	32	108	32	97	31,0	104	0,2
640	Chlorures (Cl-)	174	648	188	632	199	602	187	627	0,05
634	Cyanates (CNO-)	0,8	3,0	0,5	1,7	0,7	2,1	0,7	2,3	0,5
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,01
840	Demande biochimique en oxygène (DBO5)	17	63	17	57	21	64	18	61	2
	Demande biochimique en oxygène carbonée (DBO5)	17	63	19	64	22	67	19	65	3
820	Demande chimique en oxygène (DCO)	71	264	65	219	73	221	70	235	5
650	Fluorures totaux (F-)	<		0,05	0	0,05	0	<LIM		0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	0,3	1,1	0,3	1,0	0,3	0,9	0,3	1,0	0,1
110	Matières en suspension	17	63	19	64	21	64	19	64	4
181	Matières extractibles au fréon (Huiles et graisses totales)	1,1	4,1	0,8	2,7	0,9	2,7	0,9	3,2	0,1
680	Nitrites-nitrates (NO2-NO3)	0,7	2,6	0,6	2,0	0,6	1,8	0,6	2,1	0,01
674	Phosphore total (P tot.)	1,7	6,3	1,5	5,0	1,7	5,1	1,6	5,5	0,06
135	Solides totaux (ST)	640	2384	640	2153	680	2056	653	2198	10
610	Sulfates (SO42-)	77	287	78	262	88	266	81	272	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	<		<		<		<LIM		0,1
	Aluminium dissous	<		<		<		<LIM		0,1
410	Argent total	0,006	0.022	0,005	0,017	0,005	0,015	0,005	0,018	0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	0,002	0,007	0,001	0,0034	0,002	0,006	0,002	0,006	0,001
440	Cuivre total	0,012	0,045	0,014	0,047	0,010	0,030	0,012	0,041	0,001
460	Fer total	1,30	4,84	1,20	4,04	1,20	3,63	1,23	4,17	0,02
	Fer dissous	0,41	1,53	0,44	1,48	0,41	1,24	0,42	1,42	0,02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0,01
301	Plomb total	<		<		<		<LIM		0,0005
310	Sélénium total	<		0,001	0,003	0,001	0,003	<LIM		0,001
330	Zinc total	<		<		<		<LIM		0,01

SAWYERVILLE - HIVER 1997

	JOURNÉE	*JOUR 1*		*JOUR 3*		*JOUR 5*				
	DATE	03/02/1997		05/02/1997		07/02/1997		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	10 H 30		9 H 30		8 H 30				
	DÉBIT (m³/j)	332		377		290		333,00		
CODE	**PARAMETRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	10	3,3	10	3,8	11	3,2	10	3,4	0,1
700	Azote Kjeldahl total (N-NKT)	12	4,0	12	4,5	12	3,5	12	4,0	0,2
870	Carbone organique total (COT)	11,9	4,0	12,7	4,8	12,1	3,5	12,2	4,1	0,2
640	Chlorures (Cl-)	64	21,2	63	23,8	64	18,6	64	21,2	0,05
634	Cyanates (CNO-)	<		0,5	0,2	<		<LIM		0,5
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,01
840	Demande biochimique en oxygène (DBO5)	5	1,7	5	1,9	8	2,3	6	2,0	2
	Demande biochimique en oxygène carbonée (DBC5)	6	2,0	5	1,9	6	1,7	6	1,9	3
820	Demande chimique en oxygène (DCO)	34	11,3	30	11,3	32	9,3	32	10,6	5
650	Fluorures totaux (F-)	<		<		<		<LIM		0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	(0,4)	(0,13)	(0,1)	(0,04)	(0,3)	(0,09)	(0,3)	(0,09)	0,1
110	Matières en suspension	4	1,3	5	1,9	4	1,2	4	1,5	4
181	Matières extractibles au fréon (Huiles et graisses totales)	(1,1)	(0,37)	(1,2)	(0,45)	(0,8)	(0,23)	(1,0)	(0,35)	0,1
680	Nitrites-nitrates (NO2-NO3)	1,2	0,4	1,2	0,5	1,2	0,3	1,2	0,4	0,01
674	Phosphore total (P tot.)	1,5	0,5	1,4	0,5	1,5	0,4	1,5	0,5	0,06
135	Solides totaux (ST)	340	112,9	330	124,4	330	95,7	333	111,0	10
610	Sulfates (SO42-)	17	5,6	22	8,3	19	5,5	19	6,5	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	0,1	0,03	0,1	0,04	<		<LIM		0,1
	Aluminium dissous	<		<		<		<LIM		0,1
410	Argent total	0,003	0,001	0,002	0,001	0,002	0,001	0,002	0,001	0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	<		<		<		<LIM		0,001
440	Cuivre total	0,028	0,009	0,028	0,011	0,027	0,008	0,028	0,009	0,001
460	Fer total	0,47	0,16	0,48	0,18	0,46	0,13	0,47	0,16	0,02
	Fer dissous	0,25	0,08	0,24	0,09	0,23	0,07	0,24	0,08	0,02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0,01
301	Plomb total	0,0028	0,0009	0,0005	0,0002	0,0006	0,00	0,0013	0,00	0,0005
310	Sélénium total	<		<		<		<LIM		0,001
330	Zinc total	0,02	0,01	0,02	0,01	0,03	0,01	0,02	0,01	0,01

WARWICK - HIVER 1997

CODE	PARAMETRE	JOUR 1		JOUR 3		JOUR 5		MOYENNE ARITHMÉTIQUE		LDM
	JOURNÉE	*JOUR 1*		*JOUR 3*		*JOUR 5*				
	DATE	27/01/1997		29/01/1997		31/01/1997				
	HEURE	14 H 45		12 H 15		11 H 45				
	DÉBIT (m^3/j)	2732		2513		2405		2550,00		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	13	36	12	30	14	34	13	33	0,1
700	Azote Kjeldahl total (N-NKT)	16	44	15	38	16	38	16	40	0,2
870	Carbone organique total (COT)	32	87	35	88	36	87	34,3	87	0,2
640	Chlorures (Cl-)	110	301	112	281	116	279	113	287	0,05
634	Cyanates (CNO-)	<		<		0,8	2	<LIM		0,5
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,01
840	Demande biochimique en oxygène (DBO5)	22	60	13	33	16	38	17	44	2
	Demande biochimique en oxygène carbonée (DBO5)	17	46	16	40	17	41	17	43	3
820	Demande chimique en oxygène (DCO)	78	213	69	173	61	147	69	178	5
650	Fluorures totaux (F-)	<		<		<		<LIM		0,05
182	Hydrocarbures totaux (Huiles et graisses minérales)	0,4	1,1	0,3	0,8	0,4	1,0	0,4	0,9	0,1
110	Matières en suspension	23	63	22	55	22	53	22	57	4
181	Matières extractibles au fréon (Huiles et graisses totales)	1,6	4,4	0,9	2,3	1,2	2,9	1,2	3,2	0,1
680	Nitrites-nitrates (NO2-NO3)	2,2	6,0	1,0	2,5	1,0	2,4	1,4	3,6	0,01
674	Phosphore total (P tot.)	2,7	7,4	2,5	6,3	2,6	6,3	2,6	6,6	0,06
135	Solides totaux (ST)	570	1557	550	1382	600	1443	573	1461	10
510	Sulfates (SO42-)	44	120	60	151	53	127	52	133	1
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,02
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	0,2	0,55	0,2	0,50	0,1	0,24	0,2	0,43	0,1
	Aluminium dissous	<		<		<		<LIM		0,1
410	Argent total	0,004	0,011	0,004	0,010	0,004	0,010	0,004	0,010	0,001
320	Cadmium total	<		<		<		<LIM		0,0003
451	Chrome total	0,001	0,003	0,001	0,0025	0,001	0,002	0,001	0,003	0,001
440	Cuivre total	0,005	0,014	0,005	0,013	0,005	0,012	0,005	0,013	0,001
460	Fer total	0,38	1,04	0,34	0,85	0,34	0,82	0,35	0,90	0,02
	Fer dissous	0,17	0,46	0,17	0,43	0,17	0,41	0,17	0,43	0,02
351	Mercure total	<		<		<		<LIM		0,0001
430	Nickel total	<		<		<		<LIM		0,01
301	Plomb total	0,0006	0,0016	0,0008	0,0020	<		<LIM		0,0005
310	Sélénium total	<		<		<		<LIM		0,001
330	Zinc total	0,03	0,08	<		0,03	0,07	0,02	0,05	0,01

CHÂTEAUGUAY - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	14 au 15/06/99		16 au 17/06/99		18 au 19/06/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	37915		33855		34750		35507		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	9,3	353	9,7	328	8,5	295	9,2	325	0,01
700	Azote Kjeldahl total (N-NKT)	11	417	12	406	11	382	11	402	0,1
640	Chlorures (Cl-)	77	2919	75	2539	85	2954	79	2804	0,1
631	Cyanures totaux (CN- tot.)	0,004	0,2	<		<		<LIM		0,003
	Conductivité (µmhos/cm)	622		623		648		631		
840	Demande biochimique en oxygène (DBO5)	10	379	8	271	10	348	9	332	2
	Demande biochimique en oxygène carbonatée	9	341	6	203	9	313	8	286	3
820	Demande chimique en oxygène (DCO)	31	1175	16	542	21	730	23	816	3
	Dureté totale (titrage) (mgCaCO3/L)	210	7962	240	8125	200	6950	217	7679	1
650	Fluorures totaux (F-)	0.90	34.1	0.89	30.1	0.93	32.3	0,91	32,2	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		<		<		<LIM		0,1
110	Matières en suspension	9	341	11	372	11	382	10	365	2
680	Nitrites-nitrates (NO2-NO3)	1,0	37,9	2,0	67,7	1,3	45,2	1,4	50,3	0,01
	Nitrates (Calcul)	0.89	33,7	1,84	62.3	1.13	39,3	1,29	45,1	0,01
	Nitrites (colorimétrie)	0,11	4,2	0,16	5,4	0,17	5,9	0,15	5,2	0,0008
	Oxygène dissous	5,1		5,2		5,0		5,1		
	Phénols (colorimétrie)	0.002	0,1	0,002	0,1	<		<LIM		0,002
674	Phosphore total (P tot.)	0,99	37,5	0,52	17,6	0.48	16,7	0,66	23,9	0,02
610	Sulfates (turbidimétrie) (SO42-)	76	2882	78	2641	78	2711	77	2744	1
	Sulfures dissous	0.03	1,1	<		<		0,01	0,4	0,01
620	Sulfures totaux (S2-)	0,06	2,3	0,05	1,7	0.03	1,0	0,05	1,7	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0.570	21.6	0.450	15,2	0,740	25,7	0,587	20,9	0,002
	Antimoine	<		0,0003	0,01	<		0,0001	0,003	0,0001
	Argent	0,0005	0,02	0,0001	0,003	0,0005	0,02	0,0004	0,01	0,0001
	Arsenic	0,0004	0,02	0,0005	0,02	0,0005	0,02	0,0005	0,02	0,0001
	Baryum	0,039	1,5	0,036	1,2	0,040	1,4	0,038	1,4	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,070	2,7	0,062	2,1	0,069	2,4	0,067	2,4	0,002
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,0022	0,1	<		0,0048	0,2	0,0023	0,1	0,0001
	Cobalt	0,0002	0,01	0,0002	0,01	0,0002	0,01	0,0002	0,01	0,0002
	Cuivre	0,015	0,6	0,012	0,4	0,016	0,6	0,014	0,5	0,001
	Fer	0,270	10,2	0,220	7,4	0,260	9,0	0,250	8,9	0,02
	Mercure	3,7E-05	1,4E-03	3,9E-05	1,3E-03	4,0E-05	1,4E-03	3,9E-05	1,4E-03	6,E-06
	Molybdène	0,002	0,1	0,002	0,1	0,002	0,1	0,002	0,1	0,001
	Nickel	0,001	0,04	0,009	0,3	0,004	0,1	0,005	0,2	0,001
	Plomb	0,0005	0,02	0,0003	0,01	0,0004	0,01	0,0004	0,01	0,0001
	Sélenium	0,0003	0,01	0,0006	0,02	0,0003	0,01	0,0004	0,01	0,0001
	Vanadium	0,0006	0,02	0,0007	0,02	0,0008	0,03	0,0007	0,02	0,0002
	Zinc	0,015	0,6	0,012	0,4	0,013	0,5	0,013	0,5	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0.3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	<		<		<		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	**		**		**		<LIM		4
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		6
2100	Chlorométhane	**		**		**		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	**		**		**		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0.5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	**		**		**		<LIM		1
2400	cis-1,2-Dichloroéthylène	**		**		**		<LIM		1
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		1
2130	Dichlorodifluorométhane	**		**		**		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		1
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	**		**		**		<LIM		2

CHÂTEAUGUAY - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	14 au 15/06/99		16 au 17/06/99		18 au 19/06/99				
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	37915		33855		34750		35507		
CODE	**PARAMÈTRE**									
2161	Tétrachloroéthylène	3,7	140,3	<		<		1,2	46,8	1
2240	Toluène	<		<		<		<LIM		1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	**		**		**		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracène	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	<		<		<		<LIM		0,2
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	**		**		**		<LIM		0,3
12020	1,3-Dichlorobenzène	**		**		**		<LIM		0,4
12030	1,4-Dichlorobenzène	<		<		<		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<		<LIM		0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	<		<		<		<LIM		0,5
14030	Diéthylphtalate	**		**		**		<LIM		0,4
14040	Diméthylphtalate	**		**		**		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	<		<		<		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	<		<		<		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	<		<		<		<LIM		0,3
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	<		<		<		<LIM		0,4
16090	Hexachloroéthane	<		<		<		<LIM		0,4

CUM - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	28 AU 29/09/98		30/09 AU 1/10/98		2 AU 3/10/98		MOYENNE ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	2273000		2581000		2194000		2349333		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	4.4	10001	5.2	13421	5.0	10970	4,9	11464	0,01
700	Azote Kjeldahl total (N-NKT)	8.4	19093	9.65	24907	9.9	21721	9,3	21907	0,1
640	Chlorures (Cl-)	89	202297	84	216804	89	195266	87	204789	0,1
631	Cyanures totaux (CN- tot.)	0.03	68.2	0.02	51.6	0.02	43.9	0,02	54,6	0,01
	Conductivité (µmhos/cm)	717.5		710		730		719		
840	Demande biochimique en oxygène (DBO5)	12	27276	16	41296	34	74596	21	47723	2
	Demande biochimique en oxygène carbonatée	14	31822	19	49039	31	68014	21	49625	2
820	Demande chimique en oxygène (DCO)	105	238665	96.5	249067	110	241340	104	243024	3
	Dureté totale (titrage) (mgCaCO3/L)	165	375045	160	412960	160	351040	162	379682	1
650	Fluorures totaux (F-)	(0,31)	(704.6)	(0,30)	(774.3)	(0,31)	(680,1)	(0,31)	(719,7)	0,004
182	Hydrocarbures pétroliers (C10-C50)	0.2	454.6	0.3	774.3	0.1	219.4	0,2	482,8	0,1
110	Matières en suspension	17	38641	16	41296	20	43880	18	41272	2
680	Nitrites-nitrates (NO2-NO3)	0.03	68.2	0.02	51.6	0.035	76.8	0,03	65,5	0,02
	Nitrates (Calcul)	0.03	68.2	0.02	51.6	0.035	76.8	0,03	65,5	0,02
	Nitrites (colorimétrie)	<		<		0.0018	3.9	<LIM		0,0008
	Oxygène dissous	3.5		3		6.2		4.2		
	Phénols (colorimétrie)	0.0045	10.2	0,005	12.9	0.004	8.8	0,005	10,6	0,002
674	Phosphore total (P tot.)	0.54	1227.4	0.54	1393.7	0.63	1382.2	0.57	1334.5	0,02
610	Sulfates (turbidimétrie) (SO42-)	78	177294	77	198737	83	182102	79	186044	1
	Sulfures dissous	<		0.05	129.1	0.02	43.9	0,02	57,6	0,01
620	Sulfures totaux (S2-)	<		0.23	593.6	0.05	109.7	0,09	234,4	0,01
	Métaux totaux (MT)	mg/L		mg/L		mg/L		mg/L		mg/L
	Aluminium	1.010	2295,7	0.910	2348.7	0.970	2128.2	0,963	2257,5	0,020
	Antimoine	<		0.001	2.6	<		<LIM		0,001
	Argent	0.0010	2.3	0.0011	2.8	0.0011	2.4	0,0011	2.5	0,0001
	Arsenic	0.00029	0.7	0.00041	1.1	0.00054	1.2	0,00041	1,0	0,0001
	Baryum	0.028	63.6	0.032	82.6	0.029	63.6	0,030	70,0	0,007
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0.060	136.4	0.064	165.2	0.071	155.8	0,065	152,4	0,010
	Cadmium	0.00012	0.3	0.00014	0.4	0.00022	0.5	0,00016	0.4	0,0001
	Chrome	0.008	18.2	0.007	18.1	0.008	17.6	0.008	17.9	0,002
	Cobalt	<		<		<		<LIM		0,0002
	Cuivre	0,026	59.1	0.023	59.4	0.027	59.2	0,025	59,2	0,001
	Fer	0,200	454.6	0.230	593.6	0.200	438.8	0,210	495,7	0,050
	Mercure	1.5E-05	0.03	<		2.4E-05	0.1	1,3E-05	0,03	5,0E-06
	Molybdène	<		<		<		<LIM		0.01
	Nickel	0,006	13.6	0,006	15.5	0,006	13.2	0,006	14,1	0,002
	Plomb	0.0014	3.2	0.0016	4.1	0.0017	3.7	0,0016	3,7	0,001
	Sélénium	0.007	15.9	0.009	23.2	0.010	21.9	0,009	20,4	0,001
	Vanadium	<		<		<		<LIM		0,003
	Zinc	0.032	72.7	0.030	77.4	0.031	68.0	0,031	72,7	0,014
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/l
5020	Acrylonitrile	**		**		**		<LIM		0,3
2010	Benzène	<		<		<		<LIM		0,2
2020	Bromodichlorométhane	0.28	636.4	<		<		<LIM		0,2
2030	Bromoforme	<		<		<		<LIM		0,3
2040	Bromométhane	**		**		**		<LIM		0,4
2202	n-Butylbenzène	**		**		**		<LIM		0,3
2203	tert-Butylbenzène	<		<		<		<LIM		0,3
2060	Chlorobenzène	<		<		<		<LIM		0,1
2211	Chlorure de benzyle	<		<		<		<LIM		0,7
2070	Chloroéthane	**		**		**		<LIM		0,3
2080	2-Chloroéthylvinyl éther	<		<		<		<LIM		0,4
2100	Chlorométhane	**		**		**		<LIM		0,3
2085	Chlorure de vinyle	**		**		**		<LIM		0,4
2120	Dibromochlorométhane	<		<		<		<LIM		0,3
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,4
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,2
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,3
2150	1,2-Dichloroéthane	<		0.16	413.0	0.31	680.1	<LIM		0,2
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,5
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		0,4
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,3
2130	Dichlorodifluorométhane	<		<		<		<LIM		0,3
2180	1,2-Dichloropropane	<		<		<		<LIM		0,2
2450	cis-1,3-Dichloropropylène	**		**		**		<LIM		0,2
2460	trans-1,3-Dichloropropylène	**		**		**		<LIM		0,4
2200	Éthylbenzène	0,28	636.4	0.33	851.7	0.29	636.3	0,30	708,1	0,1
2115	Éther éthylique	**		**		**		<LIM		0,5
2245	Styrène	0.11	250.0	0.29	748.5	0.21	460.7	0,20	486,4	0,1
2050	Tétrachlorure de carbone	<		<		<		<LIM		0,5
2161	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		0,3
	Tétrachloroéthylène	**		**		**		<LIM		0,3
2162	1,2,3,4-Tétraméthylbenzène	**		**		**		<LIM		0,2

CUM - ÉTÉ 1998

		JOUR 1		JOUR 3		JOUR 5				
	JOUR - DATE	28 AU 29/09/98		30/09 AU 1/10/98		2 AU 3/10/98		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	2273000		2581000		2194000		2349333		
CODE	**PARAMÈTRE**									
2240	Toluène	**		**		**		<LIM		0,7
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,4
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,3
2270	Trichloroéthylène	<		<		<		<LIM		0,2
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		0,3
2164	1,2,4-Triméthylbenzène	2,3	5227,9	4,6	11872,6	2,7	5923,8	3,2	7674,8	0,2
2165	1,3,5-Triméthylbenzène	0,68	1545,6	1,2	3097,2	0,82	1799,1	0,90	2147,3	0,1
2243	Xylènes	1,30	2954,9	1,91	4929,7	1,69	3707,9	1,63	3864,2	0,3
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	**		**		**		<LIM		0,6
11020	Acénaphthylène	<		<		<		<LIM		0,8
11030	Anthracène	<		<		<		<LIM		1
11040	Benzo (a) anthracène	<		<		<		<LIM		1,1
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		1,9
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		1,5
11080	Benzo (a) pyrène	<		<		<		<LIM		1,9
11081	Dibenzo (a,e) pyrène	**		**		**		<LIM		0,9
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		1,3
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,4
11090	Chrysène	**		**		**		<LIM		0,7
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		1,2
11110	Fluoranthène	<		<		<		<LIM		0,8
11120	Fluorène	<		<		<		<LIM		0,9
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		1,3
11140	Naphtalène	<		<		<		<LIM		1,1
11150	Phénanthrène	<		<		<		<LIM		0,6
11160	Pyrène	<		<		<		<LIM		0,9
	Éthers halogénés:									
12090	4-Bromophényl phényl éther	**		**		**		<LIM		1,6
12091	bis (2-chloroéthoxy) méthane	**		**		**		<LIM		0,8
12092	bis (2-chloroéthyl) éther	**		**		**		<LIM		0,8
	bis (2-isopropyl) éther	<		<		<		<LIM		0,8
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,9
	Nitrosamines :									
13010	N-nitroso-diméthyl amine	<		<		<		<LIM		0,8
13020	N-nitroso-diphényl amine	<		<		<		<LIM		1,1
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		1
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,8
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,9
12030	1,4-Dichlorobenzène	2,7	6137,1	1,9	4903,9	3,3	7240,2	2,6	6093,7	0,9
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,6
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,7
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,8
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		1,2
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,9
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		1,1
12046	Pentachlorobenzène	<		<		<		<LIM		0,9
12050	Hexachlorobenzène	<		<		<		<LIM		0,8
	Esters phtaliques :									
14010	Butyl benzyl phtalate	2	4546,0	<		<		<LIM		0,7
14020	Di-n-butylphtalate	**		**		**		<LIM		0,7
14030	Diéthylphtalate	1,1	2500,3	1,3	3355,3	1,1	2413,4	1,2	2756,3	0,8
14040	Diméthylphtalate	<		<		<		<LIM		1,1
14050	Di-n-octylphtalate	<		<		<		<LIM		1,3
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1,3
16020	2-Chloronaphtalène	<		<		<		<LIM		0,6
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		5,9
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,8
16060	1,2-Diphénylhydrazine	**		**		**		<LIM		1,1
16070	Hexachlorobutadiène	**		**		**		<LIM		1,1
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		1,6
16100	Isophorone	<		<		<		<LIM		1,1
16110	Nitrobenzène	<		1,5	3871,5	2,2	4826,8	1,2	2899,4	0,9
16090	Hexachloroéthane	<		<		<		<LIM		0,9

CUM - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	7 au 8/06/99		9 au 10/06/99		11 au 12/06/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 A 8H00				
	DÉBIT (m3/j)	2228667		2265000		2199667		2231111		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	6,1	13595	5,9	13364	6,4	14078	6,1	13679	0,01
700	Azote Kjeldahl total (N-NKT)	9,6	21395	8,8	19932	9,7	21337	9,4	20888	0,1
640	Chlorures (Cl-)	97	216181	95	215175	98	215567	97	215641	0,1
631	Cyanures totaux (CN- tot.)	0,023	51,3	0,020	45,3	0,016	35,2	0,020	43,9	0,001
	Conductivité (µmhos/cm)	711		713		732		719		
840	Demande biochimique en oxygène (DBO5)	41	91375	42	95130	41	90186	41	92231	2
	Demande biochimique en oxygène carbonatée	35	78003	40	90600	38	83587	38	84064	3
820	Demande chimique en oxygène (DCO)	94	209495	109	246885	108	237564	104	231315	3
	Dureté totale (titrage) (mgCaCO3/L)	170	378873	171	387315	170	373943	170	380044	1
650	Fluorures totaux (F-)	0,17	378,9	0,19	430,4	0,19	417,9	0,18	409	0,004
182	Hydrocarbures pétroliers (C10-C50)	0,45	1002,9	0,35	792,8	0,43	945,9	0,41	914	0,1
110	Matières en suspension	20	44573	21	47565	20	43993	20	45377	2
680	Nitrites-nitrates (NO2-NO3)	0,015	33,4	0,01	22,7	0,03	66,0	0,02	40,7	0,01
	Nitrates (Calcul)	0,01	22,3	<		0,025	55,0	0,01	25,8	0,01
	Nitrites (colorimétrie)	0,005	11,1	0,006	13,6	0,005	11,0	0,005	11,9	0,0008
	Oxygène dissous	2,7		2,9		2,8		2,8		
	Phénols (colorimétrie)	0,008	17,8	0,008	18,1	0,010	22,0	0,009	19,3	0,002
674	Phosphore total (P tot.)	0,44	980,6	0,46	1041,9	0,42	923,9	0,44	982	0,02
610	Sulfates (turbidimétrie) (SO42-)	73	162693	72	163080	69	151777	71	159183	1
	Sulfures dissous	0,07	156,0	0,17	385,1	0,08	176,0	0,11	239	0,01
620	Sulfures totaux (S2-)	0,19	423,4	0,23	521,0	0,18	395,9	0,20	447	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,810	1805,2	0,716	1621,7	0,780	1715,7	0,769	1714,2	0,002
	Antimoine	0,0012	2,7	0,0016	3,6	0,0016	3,5	0,0015	3,3	0,0001
	Argent	0,0007	1,6	0,0007	1,6	0,0008	1,8	0,0007	1,6	0,0001
	Arsenic	0,0009	2,0	0,0009	2,0	0,0009	2,0	0,0009	2,0	0,0001
	Baryum	0,031	69,1	0,029	65,7	0,031	68,2	0,030	67,7	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,072	160,5	0,071	160,8	0,085	187,0	0,076	169,4	0,002
	Cadmium	0,00026	0,6	0,00039	0,9	0,00027	0,6	0,00031	0,7	0,0001
	Chrome	0,0076	16,9	0,0041	9,3	0,0043	9,5	0,0053	11,9	0,0001
	Cobalt	0,0004	0,9	0,0003	0,7	0,0004	0,9	0,0004	0,8	0,0002
	Cuivre	0,022	49,0	0,021	47,6	0,021	46,2	0,021	47,6	0,001
	Fer	0,280	624,0	0,290	656,9	0,300	659,9	0,290	646,9	0,02
	Mercure	5,0E-05	0,1	<		<		1,7E-05	0,04	6,E-06
	Molybdène	0,012	26,7	0,011	24,9	0,011	24,2	0,011	25,3	0,001
	Nickel	0,004	8,9	0,004	9,1	0,006	13,2	0,005	10,4	0,001
	Plomb	0,0014	3,1	0,0010	2,3	0,0011	2,4	0,0012	2,6	0,0001
	Sélénium	0,0036	8,0	0,0049	11,1	0,0046	10,1	0,0044	9,7	0,0001
	Vanadium	0,0007	1,6	0,0005	1,1	0,0006	1,3	0,0006	1,3	0,0002
	Zinc	0,030	66,9	0,034	77,0	0,033	72,6	0,032	72,2	0,002

CUO - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	5 AU 6/07/99		7 au 8/07/99		9 au 10/07/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	152915		136133		158366		149138		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	4,1	627	4,7	640	5,8	919	4,9	728	0,01
700	Azote Kjeldahl total (N-NKT)	4,9	749	5,4	735	6,3	998	5,5	827	0,1
640	Chlorures (Cl-)	59	9022	60	8168	63	9977	61	9056	0,1
631	Cyanures totaux (CN- tot.)	<		0,003	0,4	<		<LIM		0,003
	Conductivité (µmhos/cm)	380		399		411		397		
840	Demande biochimique en oxygène (DBO5)	<		2	272	<		<LIM		2
	Demande biochimique en oxygène carbonatée	<		<		3	475	<LIM		3
820	Demande chimique en oxygène (DCO)	38	5811	30	4084	24	3801	31	4565	3
	Dureté totale (titrage) (mgCaCO3/L)	90	13762	99	13477	99	15678	96	14306	1
650	Fluorures totaux (F-)	0,12	18,3	0,13	17,7	0,13	20,6	0,13	18,9	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		<		<		<LIM		0,1
110	Matières en suspension	3	459	2	272	4	633	3	455	2
680	Nitrites-nitrates (NO2-NO3)	4,1	627,0	2,4	326,7	3,3	522,6	3,3	492	0,01
	Nitrates (Calcul)	3,84	587,2	2,25	306,3	3,11	492,5	3,07	462	0,01
	Nitrites (colorimétrie)	0,26	39,8	0,15	20,4	0,19	30,1	0,20	30,1	0,0008
	Oxygène dissous	6,32		6,47		6,41		6,40		
	Phénols (colorimétrie)	<		0,002	0,3	0,002	0,3	<LIM		0,002
674	Phosphore total (P tot.)	0,43	65,8	0,47	64,0	0,45	71,3	0,45	67,0	0,02
610	Sulfates (turbidimétrie) (SO42-)	52	7952	48	6534	55	8710	51,7	7732	1
	Sulfures dissous	<		0,01	1,4	0,01	1,6	<LIM		0,01
620	Sulfures totaux (S2-)	0,02	3,1	<		<		<LIM		0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,082	12,5	0,066	9,0	0,11	17,4	0,086	13,0	0,002
	Antimoine	0,0002	0,03	0,0001	0,01	0,0002	0,03	0,0002	0,03	0,0001
	Argent	<		<		0,0001	0,02	<LIM		0,0001
	Arsenic	0,0004	0,1	0,0004	0,1	0,0005	0,1	0,0004	0,1	0,0001
	Baryum	0,015	2,3	0,016	2,2	0,016	2,5	0,016	2,3	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,062	9,5	0,062	8,4	0,059	9,3	0,061	9,1	0,002
	Cadmium	0,00014	0,02	<		<		<LIM		0,0001
	Chrome	0,0009	0,1	0,0010	0,1	0,0010	0,2	0,0010	0,1	0,0001
	Cobalt	0,0002	0,03	0,0002	0,03	0,0002	0,03	0,0002	0,03	0,0002
	Cuivre	0,006	0,9	0,005	0,7	0,005	0,8	0,005	0,8	0,001
	Fer	0,090	13,8	0,086	11,7	0,110	17,4	0,095	14,3	0,02
	Mercure	3,4E-05	5,2E-03	3,5E-05	4,8E-03	3,1E-05	4,9E-03	3,3,E-05	5,0E-03	6,E-06
	Molybdène	0,006	0,9	0,004	0,5	0,006	1,0	0,005	0,8	0,001
	Nickel	0,004	0,6	0,003	0,4	0,003	0,5	0,003	0,5	0,001
	Plomb	0,0004	0,1	0,0003	0,04	0,0004	0,1	0,0004	0,1	0,0001
	Sélénium	0,0002	0,03	0,0003	0,04	0,0005	0,1	0,0003	0,1	0,0001
	Vanadium	0,0004	0,1	0,0005	0,1	0,0005	0,1	0,0005	0,1	0,0002
	Zinc	0,013	2,0	0,013	1,8	0,013	2,1	0,013	1,9	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0,3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	**		**		**		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	<		<		<		<LIM		4
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		6
2100	Chlorométhane	<		<		<		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	<		<		<		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0,5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		1
2400	cis-1,2-Dichloroéthylène	**		**		**		<LIM		1
2170	trans-1,2-Dichloroéthylène	**		**		**		<LIM		1
2130	Dichlorodifluorométhane	<		<		<		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		1
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		2

CUO - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	5 AU 6/07/99		7 au 8/07/99		9 au 10/07/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	152915		136133		158366		149138		
CODE	**PARAMÈTRE**									
2161	Tétrachloroéthylène	<		<		<		<LIM		1
2240	Toluène	<		<		<		<LIM		1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	<		<		<		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracène	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		0,2
11083	Dibenzo (a,l) pyrène	**		**		**		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés :									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,3
12020	1,3-Dichlorobenzène	**		**		**		<LIM		0,4
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<		<LIM		0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	<		<		<		<LIM		0,5
14030	Diéthylphtalate	<		<		<		<LIM		0,4
14040	Diméthylphtalate	<		<		<		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	<		<		<		<LIM		0,3
16080	Hexachlorocyclopentadiène	**		**		**		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	<		<		<		<LIM		0,4
16090	Hexachloroéthane	**		**		**		<LIM		0,4

CUQ (station Est) - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	5 AU 6/07/99		7 au 8/07/99		9 au 10/07/99		MOYENNE ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	178705		230307		181372		196795		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	9,4	1680	8,4	1935	9,6	1741	9,1	1785	0,01
700	Azote Kjeldahl total (N-NKT)	12	2144	9,8	2257	13	2358	11,6	2253	0,1
640	Chlorures (Cl-)	111	19836	108	24873	160	29020	126	24576	0,1
631	Cyanures totaux (CN- tot.)	<		0,003	0,7	<		<LIM		0,003
	Conductivité (µmhos/cm)	625		573		669		622		
840	Demande biochimique en oxygène (DBO5)	13	2323	11	2533	10	1814	11	2223	2
	Demande biochimique en oxygène carbonatée	14	2502	10	2303	10	1814	11	2206	3
820	Demande chimique en oxygène (DCO)	68	12152	63	14509	65	11789	65	12817	3
	Dureté totale (titrage) (mgCaCO3/L)	131	23410	123	28328	139	25211	131	25650	1
650	Fluorures totaux (F-)	0,78	139,4	0,71	163,5	0,80	145,1	0,76	149	0,004
182	Hydrocarbures pétroliers (C10-C50)	0,33	59,0	0,67	154,3	0,26	47,2	0,42	86,8	0,1
110	Matières en suspension	10	1787	12	2764	10	1814	11	2121	2
680	Nitrites-nitrates (NO2-NO3)	0,37	66,1	0,24	55,3	0,19	34,5	0,27	52,0	0,01
	Nitrates (Calcul)	0,23	41,1	0,14	32,2	0,10	18,1	0,16	30,5	0,01
	Nitrites (colorimétrie)	0,14	25,0	0,1	23,0	0,09	16,3	0,11	21,5	0,0008
	Oxygène dissous	6,2		6,4		5,7		6,1		
	Phénols (colorimétrie)	0,005	0,9	<		<		<LIM		0,002
674	Phosphore total (P tot.)	1,45	259,1	1,09	251,0	1,20	217,6	1,25	243	0,02
610	Sulfates (turbidimétrie) (SO42-)	55	9829	55	12667	60	10882	57	11126	1
	Sulfures dissous	<		0,01	2,3	<		<LIM		0,01
620	Sulfures totaux (S2-)	0,04	7,1	0,04	9,2	0,05	9,1	0,04	8,5	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,160	28,6	0,137	31,6	0,146	26,5	0,148	28,9	0,002
	Antimoine	0,0002	0,04	0,0003	0,1	0,0002	0,04	0,0002	0,05	0,0001
	Argent	0,0025	0,4	0,0020	0,5	0,0020	0,4	0,0022	0,4	0,0001
	Arsenic	0,0005	0,1	0,0007	0,2	0,0006	0,1	0,0006	0,1	0,0001
	Baryum	0,040	7,1	0,037	8,5	0,041	7,4	0,039	7,7	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,062	11,1	0,048	11,1	0,056	10,2	0,055	10,8	0,002
	Cadmium	<		<		0,00013	0,02	<LIM		0,0001
	Chrome	0,0017	0,3	0,0015	0,3	0,0025	0,5	0,0019	0,4	0,0001
	Cobalt	0,0003	0,1	0,0003	0,1	0,0003	0,1	0,0003	0,1	0,0002
	Cuivre	0,019	3,4	0,016	3,7	0,017	3,1	0,017	3,4	0,001
	Fer	0,770	137,6	0,750	172,7	0,820	148,7	0,780	153,0	0,020
	Mercure	4,9E-05	0,01	4,5E-05	0,01	5,5E-05	0,01	5,0E-05	0,01	6,E-06
	Molybdène	0,008	1,4	0,007	1,6	0,006	1,1	0,007	1,4	0,001
	Nickel	0,005	0,9	0,004	0,9	0,004	0,7	0,004	0,8	0,001
	Plomb	0,0013	0,2	0,0015	0,3	0,0013	0,2	0,0014	0,3	0,0001
	Sélénium	0,0005	0,1	0,0007	0,2	0,0005	0,1	0,0006	0,1	0,0001
	Vanadium	0,0005	0,1	0,0007	0,2	0,0006	0,1	0,0006	0,1	0,0002
	Zinc	0,029	5,2	0,028	6,4	0,029	5,3	0,029	5,6	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0,3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	**		**		**		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	<		<		<		<LIM		4
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		6
2100	Chlorométhane	<		<		<		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	<		<		<		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0,5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	**		**		**		<LIM		1
12030	1,4-Dichlorobenzène	**		**		**		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		1
2400	cis-1,2-Dichloroéthylène	**		**		**		<LIM		1
2170	trans-1,2-Dichloroéthylène	**		**		**		<LIM		1
2130	Dichlorodifluorométhane	<		<		<		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		1
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	<		<		<		<LIM		2
2161	Tétrachloroéthylène	<		<		<		<LIM		1

CUQ (station Est) - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	5 AU 6/07/99		7 au 8/07/99		9 au 10/07/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	178705		230307		181372		196795		
CODE	**PARAMÈTRE**									
2240	Toluène	<		<		<		<LIM		1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	<		<		<		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracène	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		0,2
11083	Dibenzo (a,l) pyrène	**		**		**		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,3
12020	1,3-Dichlorobenzène	**		**		**		<LIM		0,4
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<		<LIM		0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	**		**		**		<LIM		0,5
14030	Diéthylphtalate	**		**		**		<LIM		0,4
14040	Diméthylphtalate	<		<		<		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	<		<		<		<LIM		0,3
16080	Hexachlorocyclopentadiène	**		**		**		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	<		<		<		<LIM		0,4
16090	Hexachloroéthane	**		**		**		<LIM		0,4

COOKSHIRE - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMÉTIQUE		LDM
	JOUR - DATE	13/07/99		15/07/99		17/07/99				
	DEBIT (m3/j)	1977,9		1928,3		1953		1953		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	7,1	14	7,3	14	6,1	12	6,8	13	0,01
700	Azote Kjeldahl total (N-NKT)	9,1	18	10	19	8,9	17	9,3	18	0,1
640	Chlorures (Cl-)	162	320	177	341	176	344	172	335	0,1
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,003
	Conductivité (µmhos/cm)	857		855		861		858		
840	Demande biochimique en oxygène (DBO5)	10	20	10	19	9	18	10	19	2
	Demande biochimique en oxygène carbonatée	8	16	6	12	8	16	7	14	3
820	Demande chimique en oxygène (DCO)	95	188	90	174	86	168	90	176	3
	Dureté totale (titrage) (mgCaCO3/L)	123	243	123	237	125	244	124	242	1
650	Fluorures totaux (F-)	0,12	0,24	0,10	0,19	0,12	0,23	0,11	0,22	0,004
182	Hydrocarbures pétroliers (C10-C50)	0,74	1,5	0,76	1,5	1,0	2,0	0,83	1,6	0,1
110	Matières en suspension	8	16	10	19	11	21	10	19	2
680	Nitrites-nitrates (NO2-NO3)	0,27	0,5	0,37	0,71	1,5	2,9	0,71	1,4	0,01
	Nitrates (Calcul)	0,03	0,1	0,05	0,10	0,30	0,6	0,13	0,2	0,01
	Nitrites (colorimétrie)	0,24	0,47	0,32	0,62	1,2	2,34	0,59	1,15	0,0008
	Oxygène dissous	2,7		2,6		1,8		2,4		
	Phénols (colorimétrie)	0,005	0,01	0,008	0,02	0,016	0,03	0,010	0,02	0,002
674	Phosphore total (P tot.)	1,1	2,2	1,1	2,1	1,1	2,1	1,1	2,1	0,02
610	Sulfates (turbidimétrie) (SO42-)	116	229	100	193	90	176	102	199	1
	Sulfures dissous	<		<		<		<LIM		0,01
620	Sulfures totaux (S2-)	0,08	0,2	0,08	0,2	0,06	0,1	0,07	0,1	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,048	0,09	0,050	0,1	0,048	0,1	0,049	0,1	0,002
	Antimoine	0,0002	0,0004	0,0001	0,0002	<		0,0001	0,0002	0,0001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	0,0011	0,002	0,0009	0,002	0,0010	0,002	0,0010	0,002	0,0001
	Baryum	0,016	0,03	0,017	0,03	0,017	0,03	0,017	0,03	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,043	0,1	0,041	0,1	0,041	0,1	0,042	0,1	0,002
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,020	0,04	0,021	0,04	0,018	0,04	0,020	0,04	0,0001
	Cobalt	0,0037	0,01	0,0035	0,01	0,0030	0,01	0,0034	0,01	0,0002
	Cuivre	0,029	0,1	0,028	0,1	0,027	0,1	0,028	0,1	0,001
	Fer	0,390	0,8	0,410	0,8	0,390	0,8	0,397	0,8	0,02
	Mercure	8,6E-05	1,7E-04	1,39E-04	2,7E-04	1,10E-04	2,1E-04	1,1E-04	2,2E-04	6,0E-06
	Molybdène	<		<		<		<LIM		0,001
	Nickel	0,052	0,1	0,045	0,1	0,040	0,1	0,046	0,1	0,001
	Plomb	0,0009	0,002	0,0008	0,002	0,0008	0,002	0,0008	0,002	0,0001
	Sélénium	<		<		0,0001	0,0002	<LIM		0,0001
	Vanadium	0,0003	0,001	0,0003	0,001	0,0004	0,001	0,0003	0,001	0,0002
	Zinc	0,069	0,1	0,063	0,1	0,060	0,1	0,064	0,1	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0,3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	**		**		**		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	**		**		**		<LIM		4
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		6
2100	Chlorométhane	<		<		<		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	**		**		**		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0,5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		1
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		1
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		1
2130	Dichlorodifluorométhane	**		**		**		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	**		**		**		<LIM		1
2460	trans-1,3-Dichloropropylène	**		**		**		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	**		**		**		<LIM		2

COOKSHIRE - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMETIQUE		LDM
	JOUR - DATE	13/07/99		15/07/99		17/07/99				
	DÉBIT (m3/j)	1977,9		1928,3		1953		1953		
CODE	**PARAMÈTRE**									
2161	Tétrachloroéthylène	<		<		<		<LIM		1
2240	Toluène	••		••		••		<LIM		1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	••		••		••		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracène	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	••		••		••		<LIM		0,2
11083	Dibenzo (a,l) pyrène	••		••		••		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,3
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,4
12030	1,4-Dichlorobenzène	<		<		<		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<		<LIM		0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	0,8	1,58	0,7	1,35	<		0,5	1	0,5
14030	Diéthylphtalate	<		<		<		<LIM		0,4
14040	Diméthylphtalate	••		••		••		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	••		••		••		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	••		••		••		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	<		<		<		<LIM		0,3
16080	Hexachlorocyclopentadiène	••		••		••		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	0,8	1,58	0,7	1,35	0,5	0,98	0,7	1	0,4
16090	Hexachloroéthane	<		<		<		<LIM		0,4

FARNHAM - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	12 AU 13/07/99		14 au 15/07/99		16 au 17/07/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DEBIT (m3/j)	14737		15081		11940		13919		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	<		0,50	8	1,5	18	0,7	8,5	0,01
700	Azote Kjeldahl total (N-NKT)	1,3	19	1.8	27	2,8	33	2,0	27	0,1
640	Chlorures (Cl-)	78	1149	81	1222	82	979	80	1117	0,1
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,003
	Conductivité (µmhos/cm)	571		548		575		565		
840	Demande biochimique en oxygène (DBO5)	3	44	5	75	4	48	4	56	2
	Demande biochimique en oxygène carbonatée	3	44	3	45	4	48	3	46	3
820	Demande chimique en oxygène (DCO)	36	531	28	422	46	549	37	501	3
	Dureté totale (titrage) (mgCaCO3/L)	194	2859	174	2624	170	2030	179	2504	1
650	Fluorures totaux (F-)	0,58	8,5	0,56	8,4	0,69	8,2	0,61	8,4	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		0,1	1,5	0,1	1,2	<LIM		0,1
110	Matières en suspension	6	88	8	121	15	179	10	129	2
680	Nitrites-nitrates (NO2-NO3)	2,2	32,4	0,75	11,3	0,06	0,7	1,0	14,8	0,01
	Nitrates (Calcul)	2,2	32,4	0,73	11,0	0,05	0,6	1,0	14,7	0,01
	Nitrites (colorimétrie)	0,016	0,2	0,024	0,4	0,013	0,2	0,018	0,3	0,0008
	Oxygène dissous	4,3		3,7		3,9		4,0		
	Phénols (colorimétrie)	<		0,004	0,1	<		<LIM		0,002
674	Phosphore total (P tot.)	0,17	2,5	0,20	3,0	0,33	3,9	0,2	3,2	0,02
610	Sulfates (turbidimétrie) (SO42-)	111	1636	97	1463	94	1122	101	1407	1
	Sulfures dissous	<		<		<		<LIM		0,01
620	Sulfures totaux (S2-)	0,01	0,1	0,01	0,2	0,02	0,2	0,0	0,2	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,550	8,1	0,590	8,9	0,930	11,1	0,690	9,4	0,002
	Antimoine	0,0004	0,01	0,0002	0,003	<		0,0002	0,003	0,0001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	0,0004	0,01	0,0003	0,005	0,0007	0,01	0,0005	0,01	0,0001
	Baryum	0,070	1,0	0,070	1,1	0,068	0,8	0,069	1,0	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,034	0,5	0,037	0,6	0,042	0,5	0,038	0,5	0,002
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,0007	0,01	0,0011	0,02	0,0020	0,02	0,0013	0,02	0,0001
	Cobalt	0,0018	0,03	0,0026	0,04	0,0034	0,04	0,0026	0,04	0,0002
	Cuivre	0,020	0,3	0,015	0,2	0,013	0,2	0,016	0,2	0,001
	Fer	0,270	4,0	0,300	4,5	0,460	5,5	0,343	4,7	0,02
	Mercure	8,4E-05	1,2E-03	1,16E-04	1,7E-03	1,02E-04	1,2E-03	1,0,E-04	1,4E-03	6,E-06
	Molybdène	0,014	0,2	0,020	0,3	0,029	0,3	0,021	0,3	0,001
	Nickel	0,010	0,1	0,006	0,1	0,005	0,1	0,007	0,1	0,001
	Plomb	0,0010	0,01	0,0013	0,02	0,0015	0,02	0,0013	0,02	0,0001
	Sélénium	0,0004	0,01	0,0003	0,005	0,0006	0,01	0,0004	0,01	0,0001
	Vanadium	0,0008	0,01	0,0008	0,01	0,0007	0,01	0,0008	0,01	0,0002
	Zinc	0,020	0,3	0,025	0,4	0,026	0,3	0,024	0,3	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	1	15	<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0,3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	**		**		**		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	<		<		<		<LIM		4
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		6
2100	Chlorométhane	**		**		**		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	<		<		<		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0,5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		1
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		1
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		1
2130	Dichlorodifluorométhane	**		**		**		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	**		**		**		<LIM		1
2460	trans-1,3-Dichloropropylène	**		**		**		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	**		**		**		<LIM		2

FARNHAM - ÉTÉ 1999

		JOUR 1		JOUR 3		JOUR 5				
	JOUR - DATE	12 AU 13/07/99		14 au 15/07/99		16 au 17/07/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	14737		15081		11940		13919		
CODE	**PARAMÈTRE**									
2161	Tétrachloroéthylène	<		<		<		<LIM		1
2240	Toluène	<		<		<		<LIM		1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	**		**		**		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracène	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		0,2
11083	Dibenzo (a,l) pyrène	**		**		**		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	**		**		**		<LIM		0,3
12020	1,3-Dichlorobenzène	**		**		**		<LIM		0,4
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<		<LIM		0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	0,8	11,8	0,6	9,0	<		<LIM		0,5
14030	Diéthylphtalate	<		<		<		<LIM		0,4
14040	Diméthylphtalate	**		**		**		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	**		**		**		<LIM		0,3
16080	Hexachlorocyclopentadiène	**		**		**		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	<		<		<		<LIM		0,4
16090	Hexachloroéthane	**		**		**		<LIM		0,4

JONQUIÈRE - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	14 AU 15/09/98		16 AU 17/09/98		18 AU 19/09/98		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	37906		46256		47543		43902		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	(2.1)	(79.6)	(1.4)	(64.8)	(2,3)	(109,3)	(1,9)	(84,6)	0,01
700	Azote Kjeldahl total (N-NKT)	2.4	91.0	2.3	106.4	2.3	109.3	2.3	102.2	0,1
640	Chlorures (Cl-)	36.5	1383.6	34	1572.7	37	1759.1	35,8	1571,8	0,1
631	Cyanures totaux (CN- tot.)	<		<		<		<LIM		0,01
	Conductivité (µmhos/cm)	385		385		390		387		
840	Demande biochimique en oxygène (DBO5)	2	75.8	<		<		<LIM		2
	Demande biochimique en oxygène carbonatée	<		<		<		<LIM		2
820	Demande chimique en oxygène (DCO)	21	796.0	19	878.9	20	950.9	20	875,3	3
	Dureté totale (titrage) (mgCaCO3/L)	80	3032.5	100	4625.6	100	4754.3	93	4137,5	1
650	Fluorures totaux (F-)	(0,11)	(4.2)	(0,16)	(7,4)	(0,09)	(4,3)	(0,12)	(5,3)	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		<		<		<LIM		0,1
110	Matières en suspension	3	113.7	3	138.8	2	95.1	3	115.9	2
680	Nitrites-nitrates (NO2-NO3)	0.47	17.8	1.6	74.0	2	95,1	1,36	62,3	0,02
	Nitrates (Calcul)	0,42	15,9	1.5	69.4	1,9	90,3	1,27	58.5	0,02
	Nitrites (colorimétrie)	0,047	1.8	0,083	3.8	0,057	2,7	0,062	2,8	0,0008
	Oxygène dissous	6,6		7		7,2		6.9		
	Phénols (colorimétrie)	<		<		<		<LIM		0,002
674	Phosphore total (P tot.)	0.195	7.4	0.19	8.8	0.19	9.0	0.192	8.4	0,02
610	Sulfates (turbidimétrie) (SO42-)	38	1440,4	29,5	1364,6	31	1473,8	33	1426,3	1
	Sulfures dissous	0.02	0.8	<		<		<LIM		0,01
620	Sulfures totaux (S2-)	0,01	0.4	<		<		<LIM		0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0.137	5,2	0,123	5.7	0.115	5.5	0.125	5.5	0,020
	Antimoine	<		<		<		<LIM		0,001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	<		<		<		<LIM		0,0001
	Baryum	0,018	0,7	0,020	0,9	0,019	0,9	0,019	0,8	0,007
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0.056	2,1	0.052	2,4	0,049	2,3	0,052	2,3	0,010
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,007	0,3	0,007	0,3	0,010	0,5	0,008	0,4	0,002
	Cobalt	<		0,0001	0,005	<		<LIM		0,0002
	Cuivre	0.008	0,3	0.008	0,4	0,008	0,4	0,008	0,4	0,001
	Fer	0.054	2,0	0,056	2,6	0,060	2,9	0,057	2,5	0,050
	Mercure	9E-06	3,4E-04	8E-06	3,7E-04	8E-06	3,8E-04	8E-06	3,6E-04	5E-06
	Molybdène	<		<		<		<LIM		0,01
	Nickel	<		<		<		<LIM		0,002
	Plomb	<		<		<		<LIM		0,001
	Sélénium	<		<		<		<LIM		0,001
	Vanadium	<		<		<		<LIM		0,003
	Zinc	0,020	0,8	0.020	0,9	0,019	0,9	0,020	0,9	0,014
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5020	Acrylonitrile	<		<		<		<LIM		0,3
2010	Benzène	<		<		<		<LIM		0,2
2020	Bromodichlorométhane	<		<		<		<LIM		0,2
2030	Bromoforme	<		<		<		<LIM		0,3
2040	Bromométhane	**		**		**		<LIM		0,4
2202	n-Butylbenzène	**		**		**		<LIM		0,3
2203	tert-Butylbenzène	<		<		<		<LIM		0,3
2060	Chlorobenzène	<		<		<		<LIM		0,1
2211	Chlorure de benzyle	<		<		<		<LIM		0,7
2070	Chloroéthane	**		**		**		<LIM		0,3
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		0,4
2100	Chlorométhane	**		**		**		<LIM		0,3
2085	Chlorure de vinyle	**		**		**		<LIM		0,4
2120	Dibromochlorométhane	<		<		<		<LIM		0,3
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,4
12020	1,3-Dichlorobenzène	1	37,9	<		<		0,33	12,6	0,2
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,3
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,5
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		0,4
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,3
2130	Dichlorodifluorométhane	<		<		<		<LIM		0,3
2180	1,2-Dichloropropane	<		<		<		<LIM		0,2
2450	cis-1,3-Dichloropropylène	**		**		**		<LIM		0,2
2460	trans-1,3-Dichloropropylène	**		**		**		<LIM		0,4
2200	Éthylbenzène	<		<		<		<LIM		0,1
2115	Éther éthylique	**		**		**		<LIM		0,5
2245	Styrène	<		<		<		<LIM		0,1
2050	Tétrachlorure de carbone	<		<		<		<LIM		0,5
2161	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		0,3
	Tétrachloroéthylène	1,4	53,1	0,5	23,1	1,8	85,6	1,2	53,9	0,3

JONQUIÈRE - ÉTÉ 1998

		JOUR 1		JOUR 3		JOUR 5				
	JOUR - DATE	14 AU 15/09/98		16 AU 17/09/98		18 AU 19/09/98		MOYENNE ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	37906		46256		47543		43902		
CODE	**PARAMÈTRE**									
2162	1,2,3,4-Tétraméthylbenzène	<		<		<		<LIM		0,3
2240	Toluène	1,2	45,5	<		1,4	66,6	0,9	37,3	0,7
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,4
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,3
2270	Trichloroéthylène	<		<		<		<LIM		0,2
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		0,2
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		0,2
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		0,1
2243	Xylènes	**		**		**		<LIM		0,3
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	**		**		**		<LIM		0,6
11020	Acénaphthylène	<		<		<		<LIM		0,8
11030	Anthracène	<		<		<		<LIM		1
11040	Benzo (a) anthracène	<		<		<		<LIM		1,1
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		1,9
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		1,5
11080	Benzo (a) pyrène	<		<		<		<LIM		1,9
11081	Dibenzo (a,e) pyrène	**		**		**		<LIM		0,9
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		1,3
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,4
11090	Chrysène	**		**		**		<LIM		0,7
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		1,2
11110	Fluoranthène	<		<		<		<LIM		0,8
11120	Fluorène	<		<		<		<LIM		0,9
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		1,3
11140	Naphtalène	<		<		<		<LIM		1,1
11150	Phénanthrène	<		<		<		<LIM		0,6
11160	Pyrène	<		<		<		<LIM		0,9
	Éthers halogénés									
12090	4-Bromophényl phényl éther	**		**		**		<LIM		1,6
12091	bis (2-chloroéthoxy) méthane	**		**		**		<LIM		0,8
12092	bis (2-chloroéthyl) éther	**		**		**		<LIM		0,8
	bis (2-isopropyl) éther	<		<		<		<LIM		0,8
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,9
	Nitrosamines :									
13010	N-nitroso-diméthyl amine	<		<		<		<LIM		0,8
13020	N-nitroso-diphényl amine	<		<		<		<LIM		1,1
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		1
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,8
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,9
12030	1,4-Dichlorobenzène	1,8	68,2	2,2	101,8	2,3	109,3	2,1	93,1	0,9
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,6
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,7
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,8
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		1,2
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,9
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		1,1
12046	Pentachlorobenzène	<		<		<		<LIM		0,9
12050	Hexachlorobenzène	<		<		<		<LIM		0,8
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,7
14020	Di-n-butylphtalate	15	568,6	15	693,8	6,3	299,5	12,1	520,7	0,7
14030	Diéthylphtalate	<		<		<		<LIM		0,8
14040	Diméthylphtalate	<		<		<		<LIM		1,1
14050	Di-n-octylphtalate	<		<		<		<LIM		1,3
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1,3
16020	2-Chloronaphtalène	<		<		<		<LIM		0,6
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		5,9
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,8
16060	1,2-Diphénylhydrazine	**		**		**		<LIM		1,1
16070	Hexachlorobutadiène	**		**		**		<LIM		1,1
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		1,6
16100	Isophorone	<		<		<		<LIM		1,1
16110	Nitrobenzène	<		<		<		<LIM		0,9
16090	Hexachloroéthane	<		<		<		<LIM		0,9

LA PRAIRIE - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	14 au 15/06/99		16 au 17/06/99		18 au 19/06/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	48474		44209		45690		46124		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	26	1260	22	973	25	1142	24	1125	0,01
700	Azote Kjeldahl total (N-NKT)	26	1260	22	973	27	1234	25	1156	0,1
640	Chlorures (Cl-)	197	9549	174	7692	175	7996	182	8412	0,1
631	Cyanures totaux (CN- tot.)	0,003	0,1	<		<		<LIM		0,003
	Conductivité (µmhos/cm)	1076		1003		1060		1046		
840	Demande biochimique en oxygène (DBO5)	7	339	5	221	4	183	5	248	2
	Demande biochimique en oxygène carbonatée	6	291	5	221	<		4	171	3
820	Demande chimique en oxygène (DCO)	50	2424	26	1149	46	2102	41	1892	3
	Dureté totale (titrage) (mgCaCO3/L)	270	13088	290	12821	290	13250	283	13053	1
650	Fluorures totaux (F-)	0,32	15,5	0,27	11,9	0,31	14,2	0,30	13,9	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		<		<		<LIM		0,1
110	Matières en suspension	10	485	11	486	7	320	9	430	2
680	Nitrites-nitrates (NO2-NO3)	0,18	8,7	2,80	123,8	0,22	10,1	1.07	47.5	0.01
	Nitrates (Calcul)	0,08	3,9	2,39	105,7	0,145	6,6	0,87	38,7	0,01
	Nitrites (colorimétrie)	0,10	4,8	0,41	18,1	0,075	3,4	0,20	8,8	0,0008
	Oxygène dissous	2,5		2,3		2,0		2,3		
	Phénols (colorimétrie)	0,002	0,1	0,002	0,1	<		<LIM		0,002
674	Phosphore total (P tot.)	0,60	29,1	0,45	19,9	0,63	28,8	0,56	25,9	0,02
610	Sulfates (turbidimétrie) (SO42-)	105	5090	131	5791	115	5254	117	5378	1
	Sulfures dissous	<		0,01	0,4	<		<LIM		0,01
620	Sulfures totaux (S2-)	0,01	0,5	0,02	0,9	0,02	0,9	0,02	0,8	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,092	4,5	0,172	7,6	0,074	3,4	0,113	5,1	0,002
	Antimoine	0,0006	0,03	0,0006	0,03	0,0006	0,03	0,0006	0,03	0,0001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	0,0006	0,03	0,0006	0,03	0,0006	0,03	0,0006	0,03	0,0001
	Baryum	0,015	0,7	0,018	0,8	0,016	0,7	0,016	0,8	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,160	7,8	0,180	8,0	0,190	8,7	0,177	8,1	0,002
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,0011	0,1	0,0010	0,04	0,0011	0,1	0,0011	0,05	0,0001
	Cobalt	0,0017	0,1	0,0014	0,1	0,0015	0,1	0,0015	0,1	0,0002
	Cuivre	0,010	0,5	0,008	0,4	0,008	0,4	0,009	0,4	0,001
	Fer	0,310	15,0	0,270	11,9	0,260	11,9	0,280	12,9	0,02
	Mercure	7,E-06	3,4E-04	1,7E-05	7,5E-04	2,0E-05	9,1E-04	1,5,E-05	6,7E-04	6,E-06
	Molybdène	0,004	0,2	0,006	0,3	0,005	0,2	0,005	0,2	0,001
	Nickel	0,004	0,2	0,005	0,2	0,005	0,2	0,005	0,2	0,001
	Plomb	0,0014	0,1	0,0026	0,1	0,0014	0,1	0,0018	0,1	0,0001
	Sélénium	0,0005	0,02	0,0005	0,02	0,0007	0,03	0,0006	0,03	0,0001
	Vanadium	0,0006	0,03	0,0009	0,04	0,0007	0,03	0,0007	0,03	0,0002
	Zinc	0,022	1,1	0,032	1,4	0,025	1,1	0,026	1,2	0,002
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5010	Acroléine	<		<		<		<LIM		2
5020	Acrylonitrile	<		<		<		<LIM		3
2010	Benzène	<		<		<		<LIM		1
2020	Bromodichlorométhane	<		<		<		<LIM		0,3
2030	Bromoforme	<		<		<		<LIM		1
2040	Bromométhane	<		<		<		<LIM		5
2202	n-Butylbenzène	<		<		<		<LIM		1
2203	tert-Butylbenzène	<		<		<		<LIM		1
2060	Chlorobenzène	<		<		<		<LIM		1
2070	Chloroéthane	<		<		<		<LIM		4
2080	2-Chloroéthylvinyl éther	<		<		<		<LIM		6
2100	Chlorométhane	∞		∞		∞		<LIM		5
2080	bis-Chlorométhyl éther	<		<		<		<LIM		4
2085	Chlorure de vinyle	<		<		<		<LIM		4
2120	Dibromochlorométhane	<		<		<		<LIM		0,5
12010	1,2-Dichlorobenzène	<		<		<		<LIM		1
12020	1,3-Dichlorobenzène	<		<		<		<LIM		1
12030	1,4-Dichlorobenzène	<		<		<		<LIM		1
2140	1,1-Dichloroéthane	<		<		<		<LIM		1
2150	1,2-Dichloroéthane	<		<		<		<LIM		1
2160	1,1-Dichloroéthylène	<		<		<		<LIM		1
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		1
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		1
2130	Dichlorodifluorométhane	∞		∞		∞		<LIM		3
2180	1,2-Dichloropropane	<		<		<		<LIM		1
2450	cis-1,3-Dichloropropylène	∞		∞		∞		<LIM		1
2460	trans-1,3-Dichloropropylène	∞		∞		∞		<LIM		1
2200	Éthylbenzène	<		<		<		<LIM		1
2115	Éther éthylique	<		<		<		<LIM		4
2245	Styrène	<		<		<		<LIM		1
2050	Tétrachlorure de carbone	<		<		<		<LIM		1
2220	1,1,2,2-Tétrachloroéthane	∞		∞		∞		<LIM		2
2161	Tétrachloroéthylène	<		<		<		<LIM		1

LA PRAIRIE - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	14 au 15/06/99		16 au 17/06/99		18 au 19/06/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	48474		44209		45690		46124		
CODE	**PARAMÈTRE**									
2240	Toluène	<		<		<		<LIM		1
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		1
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		1
2270	Trichloroéthylène	**		**		**		<LIM		1
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		1
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		1
2243	Xylènes	<		<		<		<LIM		2
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	<		<		<		<LIM		0,3
11020	Acénaphthylène	<		<		<		<LIM		0,3
11030	Anthracène	<		<		<		<LIM		0,4
11040	Benzo (a) anthracène	<		<		<		<LIM		0,3
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		0,3
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		0,3
11080	Benzo (a) pyrène	<		<		<		<LIM		0,3
11081	Dibenzo (a,e) pyrène	<		<		<		<LIM		0,4
11082	Dibenzo (a,i) pyrène	<		<		<		<LIM		0,2
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,6
11090	Chrysène	<		<		<		<LIM		0,3
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		0,3
11110	Fluoranthène	<		<		<		<LIM		0,4
11120	Fluorène	<		<		<		<LIM		0,3
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		0,4
11140	Naphtalène	<		<		<		<LIM		0,3
11150	Phénanthrène	<		<		<		<LIM		0,3
11160	Pyrène	<		<		<		<LIM		0,3
	Éthers halogénés									
12090	4-Bromophényl phényl éther	<		<		<		<LIM		0,3
12091	bis (2-chloroéthoxy) méthane	<		<		<		<LIM		0,3
12092	bis (2-chloroéthyl) éther	<		<		<		<LIM		0,3
12093	bis (2-chloroisopropyl) éther	<		<		<		<LIM		0,3
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,3
	Nitrosamines :									
13020	N-nitroso-diphényl amine	<		<		<		<LIM		0,3
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		0,3
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	**		**		**		<LIM		0,3
12020	1,3-Dichlorobenzène	**		**		**		<LIM		0,4
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,3
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,3
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,3
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		0,3
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,6
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		0,3
12046	Pentachlorobenzène	<		<		<		<LIM		0,3
12050	Hexachlorobenzène	<		<		<				0,3
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,3
14020	Di-n-butylphtalate	<		<		<		<LIM		0,5
14030	Diéthylphtalate	1.7	82.41	<		1.8	82.24	1.2	55	0,4
14040	Diméthylphtalate	**		**		**		<LIM		0,3
14050	Di-n-octylphtalate	<		<		<		<LIM		0,5
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1
16020	2-Chloronaphtalène	<		<		<		<LIM		0,3
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		0,3
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,4
16060	1,2-Diphénylhydrazine	<		<		<		<LIM		0,4
16070	Hexachlorobutadiène	<		<		<		<LIM		0,3
16080	Hexachlorocyclopentadiène	**		**		**		<LIM		0,3
16100	Isophorone	<		<		<		<LIM		0,3
16110	Nitrobenzène	<		<		<		<LIM		0,4
16090	Hexachloroéthane	**		**		**		<LIM		0,4

LONGUEUIL (CERS) - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	28 AU 29/09/98		30/09 AU 1/10/98		2 AU 3/10/98		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	247000		280000		250667		259222		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	9,5	2346,5	9,7	2716,0	9,4	2356,3	9,5	2472,9	0,01
700	Azote Kjeldahl total (N-NKT)	14	3458,0	13,5	3780,0	13	3258,7	14	3498,9	0,1
640	Chlorures (Cl-)	71,5	17661	67	18760	72	18048	70	18156	0,1
631	Cyanures totaux (CN- tot.)	<		0,01	2,8	<		<LIM		0,01
	Conductivité (µmhos/cm)	780		740		780		767		
840	Demande biochimique en oxygène (DBO5)	43	10621	38	10640	27	6768,0	36	9343,0	2
	Demande biochimique en oxygène carbonatée	43	10621	21	5880,0	24	6016,0	29	7505,7	2
820	Demande chimique en oxygène (DCO)	190	46930	132,5	37100	97	24315	140	36115	3
	Dureté totale (titrage) (mgCaCO3/L)	200	49400	185	51800	200	50133	195	50444	1
650	Fluorures totaux (F-)	(0,14)	(34,6)	(0,13)	(36,4)	(0,17)	(42,6)	(0,15)	(37,9)	0,004
182	Hydrocarbures pétroliers (C10-C50)	0,2	49,4	0,2	56,0	0,1	25,1	0,2	43,5	0,1
110	Matières en suspension	48	11856	19	5320,0	19	4762,7	29	7312,9	2
680	Nitrites-nitrates (NO2-NO3)	0,06	14,8	0,05	14,0	0,04	10,0	0,05	12,9	0,02
	Nitrates (Calcul)	0,04	9,9	0,03	8,4	0,02	5,0	0,03	7,8	0,02
	Nitrites (colorimétrie)	(0,024)	(5,9)	(0,024)	(6,7)	(0,017)	(4,3)	(0,022)	(5,6)	0,0008
	Oxygène dissous	6,2		6,4		6,2		6,3		
	Phénols (colorimétrie)	0,0075	1,9	0,014	3,9	0,007	1,8	0,010	2,5	0,002
674	Phosphore total (P tot.)	1,05	259,4	0,845	236,6	0,66	165,4	0,85	220,5	0,02
610	Sulfates (turbidimétrie) (SO42-)	115	28405	102,5	28700	100	25067	106	27391	1
	Sulfures dissous	0,25	61,8	0,05	14,0	0,13	32,6	0,14	36,1	0,01
620	Sulfures totaux (S2-)	0,25	61,8	0,25	70,0	0,22	55,1	0,24	62,3	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	3,570	881,8	1,920	537,6	2,300	576,5	2,597	665,3	0,020
	Antimoine	0,0018	0,4	<		<		<LIM		0,001
	Argent	0,0008	0,2	0,0005	0,1	0,0007	0,2	0,0007	0,2	0,0001
	Arsenic	0,0005	0,1	0,0012	0,3	0,00041	0,1	0,0007	0,2	0,0001
	Baryum	0,025	6,2	0,024	6,7	0,028	7,0	0,026	6,6	0,007
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,090	22,2	0,109	30,5	0,102	25,6	0,100	26,1	0,010
	Cadmium	0,00013	0,03	<		0,00017	0,04	0,00010	0,02	0,0001
	Chrome	0,019	4,7	0,014	3,9	0,045	11,3	0,026	6,6	0,002
	Cobalt	0,0004	0,1	<		<		<LIM		0,0002
	Cuivre	0,017	4,2	0,011	3,1	0,016	4,0	0,015	3,8	0,001
	Fer	0,290	71,6	0,260	72,8	0,250	62,7	0,267	69,0	0,050
	Mercure	2,6E-05	6,4E-03	2,6E-05	7,3E-03	6,0,E-06	1,5E-03	1,9E-05	5,1E-03	5,0E-06
	Molybdène	<		0,011	3,1	0,011	2,8	<LIM		0,01
	Nickel	0,005	1,2	0,007	2,0	0,008	2,0	0,007	1,7	0,002
	Plomb	0,0018	0,4	<		<		<LIM		0,001
	Sélénium	<		<		<		<LIM		0,001
	Vanadium	<		<		<		<LIM		0,003
	Zinc	0,018	4,4	0,015	4,2	0,015	3,8	0,016	4,1	0,014
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5020	Acrylonitrile	**		**		**		<LIM		0,3
2010	Benzène	<		<		<		<LIM		0,2
2020	Bromodichlorométhane	<		<		<		<LIM		0,2
2030	Bromoforme	<		<		<		<LIM		0,3
2040	Bromométhane	<		<		<		<LIM		0,4
2202	n-Butylbenzène	**		**		**		<LIM		0,3
2203	tert-Butylbenzène	<		<		<		<LIM		0,3
2060	Chlorobenzène	<		<		<		<LIM		0,1
2211	Chlorure de benzyle	<		<		<		<LIM		0,7
2070	Chloroéthane	<		<		<		<LIM		0,3
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		0,4
2100	Chlorométhane	**		**		**		<LIM		0,3
2085	Chlorure de vinyle	<		<		<		<LIM		0,4
2120	Dibromochlorométhane	<		<		<		<LIM		0,3
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,4
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,2
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
2140	1,1-Dichloroéthane	**		**		**		<LIM		0,3
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,2
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,5
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		0,4
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,3
2130	Dichlorodifluorométhane	<		<		<		<LIM		0,3
2180	1,2-Dichloropropane	<		<		<		<LIM		0,2
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		0,2
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		0,4
2200	Éthylbenzène	**		**		**		<LIM		0,1
2115	Éther éthylique	**		**		**		<LIM		0,5
2245	Styrène	0,16	39,5	0,21	58,8	0,28	70,2	0,22	56,2	0,1
2050	Tétrachlorure de carbone	<		<		<		<LIM		0,5
2161	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		0,3
	Tétrachloroéthylène	**		**		**		<LIM		0,3

LONGUEUIL (CERS) - ÉTÉ 1998

CODE	PARAMÈTRE	*JOUR 1*		*JOUR 3*		*JOUR 5*		MOYENNE ARITHMETIQUE		LDM
	JOUR - DATE	28 AU 29/09/98		30/09 AU 1/10/98		2 AU 3/10/98				
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	247000		280000		250667		259222		
2162	1,2,3,4-Tétraméthylbenzène	**		**		**		<LIM		0,2
2240	Toluène	**		**		**		<LIM		0,7
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,4
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,3
2270	Trichloroéthylène	<		<		<		<LIM		0,2
2163	1,2,3-Triméthylbenzène	**		**		**		<LIM		0,3
2164	1,2,4-Triméthylbenzène	**		**		**		<LIM		0,2
2165	1,3,5-Triméthylbenzène	0,13	32,1	0,17	47,6	0,11	27,6	0,14	35,8	0,1
2243	Xylènes	**		**		**		<LIM		0,3
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	**		**		**		<LIM		0,6
11020	Acénaphthylène	<		<		<		<LIM		0,8
11030	Anthracène	<		<		<		<LIM		1
11040	Benzo (a) anthracène	<		<		<		<LIM		1,1
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		1,9
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		1,5
11080	Benzo (a) pyrène	<		<		<		<LIM		1,9
11081	Dibenzo (a,e) pyrène	**		**		**		<LIM		0,9
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		1,3
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,4
11090	Chrysène	**		**		**		<LIM		0,7
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		1,2
11110	Fluoranthène	<		<		<		<LIM		0,8
11120	Fluorène	<		<		<		<LIM		0,9
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		1,3
11140	Naphtalène	<		<		<		<LIM		1,1
11150	Phénanthrène	<		<		<		<LIM		0,6
11160	Pyrène	<		<		<		<LIM		0,9
	Éthers halogénés :									
12090	4-Bromophényl phényl éther	**		**		**		<LIM		1,6
12091	bis (2-chloroéthoxy) méthane	**		**		**		<LIM		0,8
12092	bis (2-chloroéthyl) éther	**		**		**		<LIM		0,8
	bis (2-isopropyl) éther	<		<		<		<LIM		0,8
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,9
	Nitrosamines :									
13010	N-nitroso-diméthyl amine	<		<		<		<LIM		0,8
13020	N-nitroso-diphényl amine	<		<		<		<LIM		1,1
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		1
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,8
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,9
12030	1,4-Dichlorobenzène	3.4	839,8	2.7	756,0	3.3	827,2	3.1	807,7	0,9
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,6
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,7
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,8
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		1,2
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,9
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		1,1
12046	Pentachlorobenzène	<		<		<		<LIM		0,9
12050	Hexachlorobenzène	<		<		<		<LIM		0,8
	Esters phtaliques :									
14010	Butyl benzyl phtalate	2	494,0	<		<		<LIM		0,7
14020	Di-n-butylphtalate	**		**		**		<LIM		0,7
14030	Diéthylphtalate	2,0	494,0	1,5	420,0	<		1,2	304,7	0,8
14040	Diméthylphtalate	<		<		<		<LIM		1,1
14050	Di-n-octylphtalate	<		<		<		<LIM		1,3
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1,3
16020	2-Chloronaphtalène	<		<		<		<LIM		0,6
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		5,9
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,8
16060	1,2-Diphénylhydrazine	**		**		**		<LIM		1,1
16070	Hexachlorobutadiène	**		**		**		<LIM		1,1
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		1,6
16100	Isophorone	<		<		<		<LIM		1,1
16110	Nitrobenzène	<		<		<		<LIM		0,9
16090	Hexachloroéthane	<		<		<		<LIM		0,9

LONGUEUIL (CERS) - ÉTÉ 1999

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	7 au 8/06/99		9 au 10/06/99		11 au 12/06/99		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	8H00 À 8H00		8H00 À 8H00		8H00 À 8H00				
	DÉBIT (m3/j)	255333		239667		242333		245778		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	9,9	2528	11	2636	10	2423	10	2529	0,01
700	Azote Kjeldahl total (N-NKT)	13	3319	15	3595	13	3150	14	3355	0,1
640	Chlorures (Cl-)	82	20937	81	19413	78	18902	80	19751	0,1
631	Cyanures totaux (CN- tot.)	0,005	1,3	0,003	0,7	0,004	1,0	0,004	1,0	0,001
	Conductivité (µmhos/cm)	758		718		755		744		
840	Demande biochimique en oxygène (DBO5)	23	5873	23	5512	22	5331	23	5572	2
	Demande biochimique en oxygène carbonatée	22	5617	24	5752	21	5089	22	5486	3
20	Demande chimique en oxygène (DCO)	74	18895	66	15818	70	16963	70	17225	3
	Dureté totale (titrage) (mgCaCO3/L)	202	51577	205	49132	197	47740	201	49483	1
650	Fluorures totaux (F-)	0,20	51,1	0,12	28,8	0,09	21,8	0,14	33,9	0,004
182	Hydrocarbures pétroliers (C10-C50)	0,35	89,4	0,42	100,7	0,22	53,3	0,33	81,1	0,1
110	Matières en suspension	17	4341	16	3835	17	4120	17	4098	2
680	Nitrites-nitrates (NO2-NO3)	0,01	2,6	0,02	4,8	<		0,01	2	0,01
	Nitrates (Calcul)	<		0,015	3,6	<		<LIM		0,01
	Nitrites (colorimétrie)	0,003	0,8	0,004	1,0	0,004	1,0	0,004	0,9	0,0008
	Oxygène dissous	5,8		5,9		6,0		5,90		
	Phénols (colorimétrie)	0,017	4,3	0,01	2,4	0,009	2,2	0,01	3,0	0,002
674	Phosphore total (P tot.)	0,50	127,7	0,71	170,2	0,47	113,9	0,56	137	0,02
610	Sulfates (turbidimétrie) (SO42-)	110	28087	103	24686	99	23991	104	25588	1
	Sulfures dissous	0,05	12,8	0,20	47,9	0,16	38,8	0,14	33,2	0,01
620	Sulfures totaux (S2-)	0,15	40,9	0,21	50,3	0,27	65,4	0,21	52,2	0,01
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	1,100	280,9	0,850	203,7	0,870	210,8	0,940	231,8	0,002
	Antimoine	<		0,0001	0,02	0,0002	0,05	0,0001	0,02	0,0001
	Argent	0,0002	0,1	<		<		<LIM		0,0001
	Arsenic	0,0007	0,2	0,0006	0,1	0,0006	0,1	0,0006	0,2	0,0001
	Baryum	0,024	6,1	0,023	5,5	0,024	5,8	0,024	5,8	0,002
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,095	24,3	0,087	20,9	0,089	21,6	0,090	22,2	0,002
	Cadmium	0,00022	0,1	0,00028	0,1	0,00010	0,02	0,00020	0,05	0,0001
	Chrome	0,0047	1,2	0,0045	1,1	0,0052	1,3	0,0048	1,2	0,0001
	Cobalt	0,0004	0,1	0,0003	0,1	0,0003	0,1	0,0003	0,1	0,0002
	Cuivre	0,008	2,0	0,008	1,9	0,008	1,9	0,008	2,0	0,001
	Fer	0,279	71,2	0,260	62,3	0,280	67,9	0,273	67,1	0,020
	Mercure	<		<		<		<LIM		6,E-06
	Molybdène	0,004	1,0	0,003	0,7	0,005	1,2	0,004	1,0	0,001
	Nickel	0,006	1,5	0,006	1,4	0,004	1,0	0,005	1,3	0,001
	Plomb	0,0015	0,4	0,0005	0,1	0,0005	0,1	0,0008	0,2	0,0001
	Sélénium	0,0005	0,1	0,0006	0,1	0,0004	0,1	0,0005	0,1	0,0001
	Vanadium	0,0013	0,3	0,0012	0,3	0,0013	0,3	0,0013	0,3	0,0002
	Zinc	0,017	4,3	0,015	3,6	0,017	4,1	0,016	4,0	0,002

MARTINVILLE - ÉTÉ 1996

	DATE	24/10/96		28/10/96		30/10/96		01/11/96		MOYENNE		
	JOUR	I		II		III		IV		ARITHMETIQUE		LDM
	HEURE	8H30		8H30		8H30		8H30				
	DÉBIT (m^3/j)	945.6		760.3		561.1		1011.7		819.68		
CODE	**PARAMETRE**											
	Paramètres physico-chimiques (PPC)	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**
710	Azote ammoniacal (N-NH3)	<		<		<		<		<LIM		0,3
700	Azote Kjeldahl total (N-NKT)	6.2	5,86	6.1	4.64	7.5	4.21	6.3	6,37	6.5	5,3	0.4
870	Carbone organique total (COT)	34	32,15	31	23.57	31	17,39	32	32.37	32	26.4	0.15
640	Chlorures (Cl-)	46	43.50	45	34.21	42	23.57	40	40.47	43,25	35,4	0.18
634	Cyanates (CNO-)	<		<		<		<		<LIM		0,64
631	Cyanures totaux (CN- tot.)	<		<		<		<		<LIM		0,009
840	Demande biochimique en oxygène (DBO5)	16	15.13	18	13.69	16	8.98	21	21.25	18	14.8	4
	Demande biochimique en oxygène carbonatée	17	16.08	20	15.21	19	10,66	21	21.25	19	15.8	4
820	Demande chimique en oxygène (DCO)	125	118.20	125	95,04	135	75.75	135	136.58	130	106.4	3
650	Fluorures totaux (F-)	0,065	0.06	0,058	0,04	0.057	0.03	0,057	0.06	0,059	0,049	0,004
182	Hydrocarbures totaux (Huiles et graisses minérales)	<		<		<		<		<LIM		0.07
110	Matières en suspension	28	26,48	44	33.45	49	27,49	62	62.73	46	37.5	1,6
181	Matières extractibles au fréon (Huiles et graisses totales)	<		<		<		<		<LIM		0,08
680	Nitrites-nitrates (NO2-NO3)	0,32	0,30	0,38	0,29	0.32	0.18	0.27	0,27	0.32	0.26	0,003
674	Phosphore total (P tot.)	0.85	0,80	0.81	0,62	0.91	0,51	0.87	0.88	0.86	0,70	0.02
135	Solides totaux (ST)	255	241	295	224	315	177	305	308.57	292.5	237,7	8,4
610	Sulfates (SO42-)	9.8	9	8.8	7	9.3	5	8.8	8.90	9.18	7,5	0,28
620	Sulfures totaux (S2-)	0.08	0,08	0,08	0,06	0,11	0.06	0.1	0.10	0.09	0,07	0,04
	Métaux totaux (MT)	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**	**kg/j**	**mg/L**
470	Aluminium total	<		<		<		<		<LIM		0,04
	Aluminium soluble	<		<		<		<		<LIM		0,04
410	Argent total	<		<		<		<		<LIM		0,0011
320	Cadmium total	<		<		<		<		<LIM		0,0005
451	Chrome total	0.021	0.02	0.021	0.02	0.026	0.01	0.020	0.020	0.022	0.02	0,0003
440	Cuivre total	<		<		<		<		<LIM		0,001
460	Fer total	0,25	0.236	0,29	0.220	0.58	0.325	0.49	0.496	0.40	0.32	0.03
	Fer soluble	<		<		0.37	0.208	0.18	0.182	0.14	0.10	0,03
351	Mercure total	<		<		<		<		<LIM		0,0002
430	Nickel total	<		<		<		<		<LIM		0.03
301	Plomb total	<		<		<		<		<LIM		0,0006
310	Sélenium total	<		<		<		<		<LIM		0,004
330	Zinc total	<		<		0.01	0,006	0.02	0.020	<LIM		0.01

SAINT-GÉDÉON - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	15/09/98		17/09/98		19/09/98		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	INSTANTANÉ		INSTANTANÉ		INSTANTANÉ				
	DÉBIT (m3/j)	478,6		478,6		658,8		538,7		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	(8,3)	(4)	(8,6)	(4)	(8,2)	(5)	(8,4)	(4)	0,01
700	Azote Kjeldahl total (N-NKT)	9,1	4,4	9,9	4,7	9,3	6,1	9,4	5,1	0,1
640	Chlorures (Cl-)	66	32	64	31	64	42	65	35	0,1
631	Cyanures totaux (CN- tot.)	0.04	0.02	0,05	0.02	0,05	0.03	0,05	0,03	0,01
	Conductivité (µmhos/cm)	650		625		620		632		
840	Demande biochimique en oxygène (DBO5)	2	1,0	<		2	1,3	<LIM		2
	Demande biochimique en oxygène carbonatée	3	1,4	2	1,0	3	2,0	3	1,5	2
820	Demande chimique en oxygène (DCO)	39	19	37	18	31	20	36	19	3
	Dureté totale (titrage) (mgCaCO3/L)	145	69	140	67	140	92	142	76	1
650	Fluorures totaux (F-)	(0,2)	(0,1)	(0,2)	(0,1)	(0,2)	(0,1)	(0,2)	(0,1)	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		<		<		<LIM		0,1
110	Matières en suspension	<		<		<		<LIM		2
680	Nitrites-nitrates (NO2-NO3)	1,8	0,9	1,8	0,9	1,9	1,3	1,8	1,0	0,02
	Nitrates (Calcul)	1,2	0,6	1,2	0,6	1,4	0,9	1,3	0,7	0,02
	Nitrites (colorimétrie)	0,59	0,3	0,57	0,3	0,55	0,4	0,57	0,3	0,0008
	Oxygène dissous	5,1		4,2		5,1		4,8		
	Phénols (colorimétrie)	0,0025	0,001	0,002	0,001	<		<LIM		0,002
674	Phosphore total (P tot.)	2,2	1,1	2,3	1,1	2,2	1,4	2,2	1,2	0,02
610	Sulfates (turbidimétrie) (SO42-)	35	17	34	16	34	22	34	18	1
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,062	0,03	0,067	0,03	0,061	0,04	0,063	0,03	0,020
	Antimoine	<		<		<		<LIM		0,001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	<		<		<		<LIM		0,0001
	Baryum	0.014	0.01	0,014	0.01	0,014	0,01	0,014	0,01	0,007
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,043	0,02	0,038	0.02	0,036	0,02	0,039	0,02	0,010
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0.006	0,003	0,005	0.002	0,004	0.003	0,005	0.003	0,002
	Cobalt	<		<		<		<LIM		0,0002
	Cuivre	0,016	0,01	0,014	0,01	0,014	0,01	0,015	0,01	0,001
	Fer	0.230	0,1	0,220	0,1	0,210	0,1	0,220	0,1	0,050
	Mercure	1.2E-05	5,7E-06	1,1E-05	5,3E-06	1,0E-05	6,6E-06	1,1E-05	5,9E-06	5,0E-06
	Molybdène	<		<		<		<LIM		0,01
	Nickel	<		<		<		<LIM		0,002
	Plomb	<		<		0,0010	0,001	<LIM		0,001
	Sélénium	<		<		<		<LIM		0,001
	Vanadium	<		<		<		<LIM		0,003
	Zinc	0,034	0,02	<		<		<LIM		0,014
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5020	Acrylonitrile	<		<		<		<LIM		0,4
2010	Benzène	<		<		<		<LIM		0,2
2020	Bromodichlorométhane	<		<		<		<LIM		0,2
2030	Bromoforme	<		<		<		<LIM		0,3
2040	Bromométhane	**		**		**		<LIM		0,4
2202	n-Butylbenzène	**		**		**		<LIM		0,3
2203	tert-Butylbenzène	<		<		<		<LIM		0,3
2060	Chlorobenzène	<		<		<		<LIM		0,1
2211	Chlorure de benzyle	<		<		<		<LIM		0,7
2070	Chloroéthane	<		<		<		<LIM		0,3
2080	2-Chloroéthylvinyl éther	**		**		**		<LIM		0,4
2100	Chlorométhane	**		**		**		<LIM		0,3
2085	Chlorure de vinyle	**		**		**		<LIM		0,4
2120	Dibromochlorométhane	<		<		<		<LIM		0,3
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,2
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,2
12030	1,4-Dichlorobenzène	**		**		**		<LIM		0,3
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,3
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,2
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,5
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		0,2
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,3
2130	Dichlorodifluorométhane	**		**		**		<LIM		0,3
2180	1,2-Dichloropropane	<		<		<		<LIM		0,2
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		0,2
2460	trans-1,3-Dichloropropylène	**		**		**		<LIM		0,4
2200	Éthylbenzène	<		<		<		<LIM		0,1
2115	Éther éthylique	**		**		**		<LIM		0,5
2245	Styrène	<		<		<		<LIM		0,1
2050	Tétrachlorure de carbone	<		<		<		<LIM		0,5
2161	1,1,2,2-Tétrachloroéthylène	<		<		<		<LIM		0,3
	Tétrachloroéthylène	<		<		<		<LIM		0,3
2162	1,2,3,4-Tétraméthylbenzène	**		**		**		<LIM		0,3
2240	Toluène	1,5	0,7	<		<		<LIM		0,7

SAINT-GÉDÉON - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	15/09/98		17/09/98		19/09/98		MOYENNE ARITHMÉTIQUE		LDM
	HEURE	INSTANTANÉ		INSTANTANÉ		INSTANTANÉ				
	DÉBIT (m3/j)	478,6		478,6		658,8		538,7		
CODE	**PARAMÈTRE**									
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,4
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,3
2270	Trichloroéthylène	<		<		<		<LIM		0,2
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		0,2
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		0,2
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		0,1
2243	Xylènes	<		<		<		<LIM		0,3
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	**		**		**		<LIM		0,6
11020	Acénaphthylène	<		<		<		<LIM		0,8
11030	Anthracène	<		<		<		<LIM		1
11040	Benzo (a) anthracène	<		<		<		<LIM		1,1
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		1,9
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		1,5
11080	Benzo (a) pyrène	<		<		<		<LIM		1,9
11081	Dibenzo (a,e) pyrène	**		**		**		<LIM		0,9
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		1,3
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,4
11090	Chrysène	**		**		**		<LIM		0,7
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		1,2
11110	Fluoranthène	<		<		<		<LIM		0,8
11120	Fluorène	<		<		<		<LIM		0,9
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		1,3
11140	Naphtalène	<		<		<		<LIM		1,1
11150	Phénanthrène	<		<		<		<LIM		0,6
11160	Pyrène	<		<		<		<LIM		0,9
	Éthers halogénés :									
12090	4-Bromophényl phényl éther	**		**		**		<LIM		1,6
12091	bis (2-chloroéthoxy) méthane	**		**		**		<LIM		0,8
12092	bis (2-chloroéthyl) éther	**		**		**		<LIM		0,8
	bis (2-isopropyl) éther	<		<		<		<LIM		0,8
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,9
	Nitrosamines :									
13010	N-nitroso-diméthyl amine	<		<		<		<LIM		0,8
13020	N-nitroso-diphényl amine	<		<		<		<LIM		1,1
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		1
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,8
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,9
12030	1,4-Dichlorobenzène	1,3	0.6	0.98	0.5	2,4	1.6	1,6	0.9	0,9
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,6
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,7
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,8
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		1,2
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,9
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		1,1
12046	Pentachlorobenzène	<		<		<		<LIM		0,9
12050	Hexachlorobenzène	<		<		<		<LIM		0,8
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,7
14020	Di-n-butylphtalate	11	5,3	4	1.9	19	12,5	11	6,6	0,7
14030	Diéthylphtalate	<		<		<		<LIM		0,8
14040	Diméthylphtalate	<		<		<		<LIM		1,1
14050	Di-n-octylphtalate	<		<		<		<LIM		1,3
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1,3
16020	2-Chloronaphtalène	<		<		<		<LIM		0,6
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		5,9
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,8
16060	1,2-Diphénylhydrazine	**		**		**		<LIM		1,1
16070	Hexachlorobutadiène	**		**		**		<LIM		1,1
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		1,6
16100	Isophorone	<		<		<		<LIM		1,1
16110	Nitrobenzène	<		<		1	0,7	<LIM		0,9
16090	Hexachloroéthane	<		<		<		<LIM		0,9

SAINT-JOSEPH-DE-BEAUCE - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	21/09/98		23/09/98		25/09/98		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	INSTANTANÉ		INSTANTANÉ		INSTANTANÉ				
	DEBIT (m3/j)	2823		4822		3867		3837,3		
CODE	**PARAMÈTRE**									
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	(1,3)	(4)	(0,7)	(3)	(1,3)	(5)	(1,1)	(4)	0,01
700	Azote Kjeldahl total (N-NKT)	2,9	8	3,35	16	3,3	13	3,2	12	0,1
640	Chlorures (Cl-)	135	381	135	651	140	541	137	524	0,1
631	Cyanures totaux (CN- tot.)	0,135	0,38	0,11	0,53	0,15	0,58	0,13	0,50	0,01
	Conductivité (µmhos/cm)	930		925		930		928		
840	Demande biochimique en oxygène (DBO5)	5	14	4	19	9	35	6,0	23	2
	Demande biochimique en oxygène carbonatée	<		6	29	5	19	4	16	2
820	Demande chimique en oxygène (DCO)	90	254	86	415	91	352	89	340	3
	Dureté totale (titrage) (mgCaCO3/L)	155	438	155	747	155	599	155	595	1
650	Fluorures totaux (F-)	(0,07)	(0,2)	(0,06)	(0,3)	(0,06)	(0,2)	(0,06)	(0,2)	0,004
182	Hydrocarbures pétroliers (C10-C50)	<		<		<		<LIM		0,1
110	Matières en suspension	36	102	35	169	40	155	37	142	2
680	Nitrites-nitrates (NO2-NO3)	23	64,9	22	106,1	22	85,1	22	85,4	0,02
	Nitrates (Calcul)	<		<		12	46,4	4	15,5	0,02
	Nitrites (colorimétrie)	25	70,6	23	110,9	11	42,5	20	74,7	0,0008
	Oxygène dissous	9,9		7,9		8,2		9		
	Phénols (colorimétrie)	<		<		<		<LIM		0,002
674	Phosphore total (P tot.)	0,74	2,1	0,71	3,4	0,70	2,7	0,72	2,7	0,02
610	Sulfates (turbidimétrie) (SO42-)	115	325	115	555	110	425	113	435	1
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
	Aluminium	0,059	0,2	0,055	0,3	0,058	0,2	0,057	0,2	0,020
	Antimoine	<		<		<		<LIM		0,001
	Argent	<		<		<		<LIM		0,0001
	Arsenic	0,00030	0,001	0,00016	0,001	0,00013	0,001	0,00020	0,001	0,0001
	Baryum	0,019	0,1	0,017	0,08	0,018	0,1	0,018	0,1	0,007
	Béryllium	<		<		<		<LIM		0,0001
	Bore	0,038	0,1	0,030	0,1	0,030	0,1	0,033	0,1	0,010
	Cadmium	<		<		<		<LIM		0,0001
	Chrome	0,005	0,01	0,005	0,02	0,003	0,01	0,004	0,02	0,002
	Cobalt	0,0009	0,003	0,0009	0,004	0,0009	0,003	0,0009	0,003	0,0002
	Cuivre	0,010	0,03	0,010	0,05	0,010	0,04	0,010	0,0	0,001
	Fer	0,510	1,4	0,450	2,2	0,530	2,0	0,497	1,9	0,050
	Mercure	2,0E-05	5,6E-05	2,0E-05	9,6E-05	2,5E-05	9,7E-05	2,2E-05	8,3E-05	5,0E-06
	Molybdène	<		<		<		<LIM		0,01
	Nickel	0,009	0,03	0,008	0,04	0,008	0,03	0,008	0,03	0,002
	Plomb	0,0004	0,001	0,0005	0,002	0,0004	0,002	0,0004	0,002	0,0001
	Sélénium	<		<		<		<LIM		0,001
	Vanadium	<		<		<		<LIM		0,003
	Zinc	<		<		<		<LIM		0,014
	Substances organiques volatiles (SOV)	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
5020	Acrylonitrile	**		**		**		<LIM		0,4
2010	Benzène	<		<		<		<LIM		0,2
2020	Bromodichlorométhane	<		<		<		<LIM		0,2
2030	Bromoforme	<		<		<		<LIM		0,3
2040	Bromométhane	<		<		<		<LIM		0,4
2202	n-Butylbenzène	**		**		**		<LIM		0,3
2203	tert-Butylbenzène	<		<		<		<LIM		0,3
2060	Chlorobenzène	<		<		<		<LIM		0,1
2211	Chlorure de benzyle	<		<		<		<LIM		0,7
2070	Chloroéthane	<		<		<		<LIM		0,3
2080	2-Chloroéthylvinyl éther	<		<		<		<LIM		0,4
2100	Chlorométhane	<		<		<		<LIM		0,3
2085	Chlorure de vinyle	**		**		**		<LIM		0,4
2120	Dibromochlorométhane	<		<		<		<LIM		0,3
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,2
12020	1,3-Dichlorobenzène	<		0,6	2,9	<		0,20	1,0	0,2
12030	1,4-Dichlorobenzène	0,31	0,9	0,55	2,7	0,48	1,9	0,45	1,8	0,3
2140	1,1-Dichloroéthane	<		<		<		<LIM		0,3
2150	1,2-Dichloroéthane	<		<		<		<LIM		0,2
2160	1,1-Dichloroéthylène	<		<		<		<LIM		0,5
2400	cis-1,2-Dichloroéthylène	<		<		<		<LIM		0,2
2170	trans-1,2-Dichloroéthylène	<		<		<		<LIM		0,3
2130	Dichlorodifluorométhane	<		<		<		<LIM		0,3
2180	1,2-Dichloropropane	<		<		<		<LIM		0,2
2450	cis-1,3-Dichloropropylène	<		<		<		<LIM		0,2
2460	trans-1,3-Dichloropropylène	<		<		<		<LIM		0,4
2200	Éthylbenzène	<		<		<		<LIM		0,1
2115	Éther éthylique	**		**		**		<LIM		0,5
2245	Styrène	<		<		<		<LIM		0,1
2050	Tétrachlorure de carbone	<		<		<		<LIM		0,5
2161	1,1,2,2-Tétrachloroéthylène	**		**		**		<LIM		0,3
	Tétrachloroéthylène	0,35	1,0	0,97	4,7	0,73	2,8	0,68	2,8	0,3
2162	1,2,3,4-Tétraméthylbenzène	<		<		<		<LIM		0,3
2240	Toluène	<		0,98	4,7	0,87	3,4	<LIM		0,7

SAINT-JOSEPH-DE-BEAUCE - ÉTÉ 1998

		JOUR 1		*JOUR 3*		*JOUR 5*				
	JOUR - DATE	21/09/98		23/09/98		25/09/98		MOYENNE		
								ARITHMÉTIQUE		LDM
	HEURE	INSTANTANÉ		INSTANTANÉ		INSTANTANÉ				
	DÉBIT (m3/j)	2823		4822		3867		3837,3		
CODE	**PARAMÈTRE**									
2250	1,1,1-Trichloroéthane	<		<		<		<LIM		0,4
2260	1,1,2-Trichloroéthane	<		<		<		<LIM		0,3
2270	Trichloroéthylène	<		<		<		<LIM		0,2
2163	1,2,3-Triméthylbenzène	<		<		<		<LIM		0,2
2164	1,2,4-Triméthylbenzène	<		<		<		<LIM		0,2
2165	1,3,5-Triméthylbenzène	<		<		<		<LIM		0,1
2243	Xylènes	**		**		**		<LIM		0,3
	(SOBN)									
	HAP :	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L	g/j	µg/L
11010	Acénaphthène	**		**		**		<LIM		0,6
11020	Acénaphthylène	<		<		<		<LIM		0,8
11030	Anthracène	<		<		<		<LIM		1
11040	Benzo (a) anthracène	<		<		<		<LIM		1,1
11050	Benzo (b+j+k) fluoranthène	<		<		<		<LIM		1,9
11070	Benzo (g,h,i) pérylène	<		<		<		<LIM		1,5
11080	Benzo (a) pyrène	<		<		<		<LIM		1,9
11081	Dibenzo (a,e) pyrène	**		**		**		<LIM		0,9
11082	Dibenzo (a,i) pyrène	**		**		**		<LIM		1,3
11083	Dibenzo (a,l) pyrène	<		<		<		<LIM		0,4
11090	Chrysène	**		**		**		<LIM		0,7
11031	Dibenzo (a,h) anthrancène	<		<		<		<LIM		1,2
11110	Fluoranthène	<		<		<		<LIM		0,8
11120	Fluorène	<		<		<		<LIM		0,9
11161	Indéno (1,2,3-cd) pyrène	<		<		<		<LIM		1,3
11140	Naphtalène	<		<		<		<LIM		1,1
11150	Phénanthrène	<		<		<		<LIM		0,6
11160	Pyrène	<		<		<		<LIM		0,9
	Éthers halogénés :									
12090	4-Bromophényl phényl éther	**		**		**		<LIM		1,6
12091	bis (2-chloroéthoxy) méthane	**		**		**		<LIM		0,8
12092	bis (2-chloroéthyl) éther	**		**		**		<LIM		0,8
	bis (2-isopropyl) éther	<		<		<		<LIM		0,8
12094	4-Chlorophényl phényl éther	<		<		<		<LIM		0,9
	Nitrosamines :									
13010	N-nitroso-diméthyl amine	<		<		<		<LIM		0,8
13020	N-nitroso-diphényl amine	<		<		<		<LIM		1,1
13030	N-nitroso-di-n-propyl amine	<		<		<		<LIM		1
	Benzènes chlorés :									
12010	1,2-Dichlorobenzène	<		<		<		<LIM		0,8
12020	1,3-Dichlorobenzène	<		<		<		<LIM		0,9
12030	1,4-Dichlorobenzène	1,8	5,1	1,6	7,7	2,1	8,1	1,8	7,0	0,9
12041	1,2,3-Trichlorobenzène	<		<		<		<LIM		0,6
12040	1,2,4-Trichlorobenzène	<		<		<		<LIM		0,7
12042	1,3,5-Trichlorobenzène	<		<		<		<LIM		0,8
12043	1,2,3,4-Tétrachlorobenzène	<		<		<		<LIM		1,2
12044	1,2,3,5-Tétrachlorobenzène	<		<		<		<LIM		0,9
12045	1,2,4,5-Tétrachlorobenzène	<		<		<		<LIM		1,1
12046	Pentachlorobenzène	<		<		<		<LIM		0,9
12050	Hexachlorobenzène	<		<		<		<LIM		0,8
	Esters phtaliques :									
14010	Butyl benzyl phtalate	<		<		<		<LIM		0,7
14020	Di-n-butylphtalate	**		**		**		<LIM		0,7
14030	Diéthylphtalate	<		<		<		<LIM		0,8
14040	Diméthylphtalate	<		<		<		<LIM		1,1
14050	Di-n-octylphtalate	<		<		<		<LIM		1,3
	Autres composés :									
16140	Benzidine	**		**		**		<LIM		1,3
16020	2-Chloronaphtalène	<		<		<		<LIM		0,6
16030	3,3-Dichlorobenzidine	**		**		**		<LIM		5,9
16040	2,4-Dinitrotoluène	<		<		<		<LIM		0,8
16060	1,2-Diphénylhydrazine	**		**		**		<LIM		1,1
16070	Hexachlorobutadiène	**		**		**		<LIM		1,1
16080	Hexachlorocyclopentadiène	<		<		<		<LIM		1,6
16100	Isophorone	<		<		<		<LIM		1,1
16110	Nitrobenzène	<		<		<		<LIM		0,9
16090	Hexachloroéthane	<		<		<		<LIM		0,9

SAWYERVILLE - ÉTÉ 1996

CODE	PARAMETRE									
	DATE	23/09/96		25/09/96		27/09/96		MOYENNE		
	JOUR	*JOUR 1*		*JOUR 3*		*JOUR 5*		ARITHMÉTIQUE		LDM
	HEURE	8H45		8H15		8H15				
	DÉBIT (m^3/j)	289,8		289,8		215,9		265,17		
	Paramètres physico-chimiques (PPC)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
710	Azote ammoniacal (N-NH3)	1.5	0.43	1.7	0.49	1.6	0.35	1,6	0,42	0.3
700	Azote Kjeldahl total (N-NKT)	2.9	0.84	2.9	0.84	2.9	0.63	2,9	0,77	0.4
870	Carbone organique total (COT)	7.4	2.14	7.7	2.23	7.4	1,60	7,5	1,99	0,15
640	Chlorures (Cl-)	43	12.5	40	11.6	42	9.1	42	11,0	0,18
634	Cyanates (CNO-)	<		<		<		<LIM		0,64
631	Cyanures totaux (CN- tot.)	0.02	0,006	0,02	0,006	0.02	0,0043	0,02	0,005	0,009
840	Demande biochimique en oxygène (DBO5)	<		<		4	0,86	<LIM		4
	Demande biochimique en oxygène carbonée	<		<		<		<LIM		4
820	Demande chimique en oxygène (DCO)	23	6,7	23	6,7	23	5,0	23	6,1	3
650	Fluorures totaux (F-)	0,061	0.018	0.077	0,022	0,071	0.015	0,070	0.018	0,004
182	Hydrocarbures totaux (Huiles et graisses minérales)	(<)		(<)		(0,11)	(0,02)	(<LIM)		0,07
110	Matières en suspension	2.9	0.84	3.9	1.13	4	0.86	3,6	0,94	1,6
161	Matières extractibles au fréon (Huiles et graisses totales)	(<)		(<)		(0,23)	(0,05)	(<LIM)		0,08
680	Nitrites-nitrates (NO2-NO3)	2.4	0.70	2.4	0.70	2,2	0.47	2,3	0,62	0,003
674	Phosphore total (P tot.)	0,43	0.125	0,44	0,128	0,41	0,089	0,43	0,114	0,02
135	Solides totaux (ST)	335	97.1	335	97.1	320	69,1	330,0	87,8	8,4
610	Sulfates (SO42-)	29	8.4	29	8.4	29	6,3	29,0	7,7	0,28
620	Sulfures totaux (S2-)	<		<		<		<LIM		0,04
	Métaux totaux (MT)	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L	kg/j	mg/L
470	Aluminium total	<		<		<		<LIM		0,04
	Aluminium soluble	<		<		<		<LIM		0,04
410	Argent total	(<)		(<)		(<)		(<LIM)		0,0011
320	Cadmium total	<		<		<		<LIM		0,0005
451	Chrome total	<		0,0425	0.01	<		0,0142	0,004	0,0003
440	Cuivre total	0,002	0.0006	0,002	0.0006	0.002	0,0004	0,002	0,0005	0,001
460	Fer total	<		<		<		<LIM		0,03
	Fer soluble	<		<		<		<LIM		0,03
351	Mercure total	<		<		<		<LIM		0,0002
430	Nickel total	<		<		<		<LIM		0,03
301	Plomb total	<		<		<		<LIM		0,0006
310	Sélénium total	<		<		<		<LIM		0,004
330	Zinc total	<		<		<		<LIM		0,01

APPENDIX 9

RESULTS OF ANALYSES FOR SURFACTANTS

RESULTS OF ANALYSES FOR SURFACTANTS

NONIONIC SURFACTANTS – WINTER

STATIONS ÉCHANTILLONNÉES	JOUR 1		JOUR 3		JOUR 5		LDM (mg/L)
	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	
CUM - 1996	1,1	2 727	0,9	2 172	0,9	2 478	0,1
Cookshire - 1997	3,7	4,5	4,0	5,1	4,4	5.5	0,1
Farnham - 1997	0,7	9,0	1,6	20,4	2,0	26,2	0,1
Martinville - 1999	<		<		<		0,1
Warwick - 1997	0,7	1,9	0,8	2,0	0,8	1,9	0,1

< : inférieur à la limite de détection de la méthode (LDM)

ANIONIC SURFACTANTS – WINTER

STATIONS ÉCHANTILLONNÉES	JOUR 1		JOUR 3		JOUR 5		LDM (mg/L)
	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	
CUM - 1996	1,80	4 462	2,10	5 068	2,40	6 608	0,02
Cookshire - 1997	2,10	2,6	1,90	2,4	2,40	3,0	0,02
Farnham - 1997	0,30	3,9	0,65	8,3	0,70	9,2	0,02
Martinville - 1999	0,21	0,4	0,17	0,3	0,13	0,2	0,02
Warwick - 1997	0,16	0,4	0,19	0,5	0,19	0,5	0,02

RESULTS OF ANALYSES FOR SURFACTANTS

NONIONIC SURFACTANTS – SUMMER

STATIONS ÉCHANTILLONNÉES	JOUR 1		JOUR 3		JOUR 5		LDM (mg/L)
	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	
Châteauguay - 1999	0,2	7,6	0,3	10,2	0,2	7,0	0,1
CUM - 1998	0,9	2 046	0,9	2 323	1,0	2 194	0,1
- 1999	3,3	7 355	1,3	2 945	0,6	1 320	0,1
CUO - 1999	<		<		<		0,1
CUQ - 1999	0,3	53,6	0,2	46,1	0,3	54,4	0,1
Cookshire - 1999	<		0,2	0,4	<		1,0-0,1 (1)
Farnham - 1999	<		<		<		1,0
Jonquière - 1998	<		<		<		0,1
La Prairie - 1999	<		<		<		0,1
Longueuil - 1998	5,0	1 235	4,0	1 120	2,9	727	0,1
- 1999	1,1	281	3,3	791	1,6	388	0,1
Saint-Gédéon - 1998	<		<		<		0,1
St-Jos.-de-Beauce - 1998	<		<		<		0,1
Sawyerville - 1997	*		*		*		0,1

< : inférieur à la limite de détection de la méthode (LDM)

* : résultat rejeté

(1) : Cookshire LDM jours 1 et 5 = 1,0 mg/L; LDM jour 3 = 0,1 mg/L.

ANIONIC SURFACTANTS – SUMMER

STATIONS ÉCHANTILLONNÉES	JOUR 1		JOUR 3		JOUR 5		LDM (mg/L)
	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	Conc. (mg/L)	Charges (kg/d)	
Châteauguay - 1999	1,30	49,3	0,55	18,6	0,89	30,9	0,02
CUM - 1998	2,40	5 455	2,00	5 162	2,40	5 266	0,02
- 1999	1,80	4 012	1,70	3 851	1,80	3 959	0,02
CUO - 1999	0,08	12,2	0,15	20,4	0,12	19,0	0,02
CUQ - 1999	1,40	250	1,20	276	1,30	236	0,02
Cookshire - 1999	0,48	1,0	0,40	0,8	0,39	0,8	0,02
Farnham - 1999	0,43	6,3	0,43	6,5	0,66	7,9	0,02
Jonquière - 1998	0,17	6,4	0,11	5,1	0,10	4,8	0,02
La Prairie - 1999	0,30	14,5	0,23	10,2	0,18	8,2	0,02
Longueuil - 1998	21,00	5 187	14,00	3 920	11,00	2 757	0,02
- 1999	3,40	868	2,50	599	3,60	872	0,02
Saint-Gédéon - 1998	0,46	0,2	0,48	0,2	0,41	0,3	0,02
St-Jos.-de-Beauce - 1998	0,30	0,9	0,28	1,4	0,26	1,0	0,02
Sawyerville - 1997	<		<		<		0,07

< : inférieur à la limite de détection de la méthode (LDM)

APPENDIX 10

RESULTS OF ANALYSES FOR TRACE-LEVEL PCBs

Winter sampling: pages 141 to 152
Summer sampling: pages 153 to 174

Explanatory note on the presentation of results in Appendix 10:

The analysis of organic substances at trace levels first requires separation of the dissolved and particulate phases from samples, followed by extraction and then purification of each phase.

During the 1996–97 sampling campaign, the purified dissolved and particulate phases were analysed separately. The tabulated results for PCBs at plants sampled in 1996 and 1997 therefore present the analytical results for both phases, plus the mathematical value of the sum of these two results, with the aim of obtaining the total concentration of the sample.

During the 1998–99 sampling campaign, in a cost-saving effort, the purified extracts of both phases were mixed and the total concentration was analysed from this combined extract. Consequently, the tabulated results of plants sampled in 1998 and 1999 present a single analytical result per sampling day.

CUQ (station Est) - HIVER 97

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1997/01/06-07)						Jour 3 (1997/01/08-09)						Jour 5 (1997/01/10-11)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)
Planaires																		
IUPAC # 77	4,39	0,1	11	0,1	15,39	2 482	4,6	0,1	12	0,1	16,6	2 510	3,4	0,04	11	0,1	14,4	2 289
IUPAC # 126	ND	0,2	ND	2	0	0	ND	0,1	ND	2	0	0	ND	0,1	ND	0,2	0	0
IUPAC # 169	ND	0,1	ND	0,2	0	0	ND	0,2	ND	0,2	0	0	ND	0,09	ND	0,1	0	0
Trichlorobiphényles																		
IUPAC # 18	170	1	75	1	245	39 512	170	1	150	2	320	48 395	530	1	270	1	800	127 191
IUPAC # 17	53	1	32	1	85	13 708	48	1	140	2	188	28 432	160	1	99	1	259	41 178
IUPAC # 31 + 28	190	2	220	1	410	66 122	200	2	530	1	730	110 401	580	2	850	1	1430	227 354
IUPAC # 33 '	74	2	77	1	151	24 352	78	3	95	1	173	26 163	250	5	350	1	600	95 393
Tétrachlorobiphényles																		
IUPAC # 52	130	1	170	1	300	48 382	120	2	210	1	330	49 907	200	1	420	1	620	98 573
IUPAC # 49 '	50	1	67	1	117	18 869	49	1	88	1	137	20 719	120	2	260	1	380	60 416
IUPAC # 44 '	82	1	110	1	192	30 965	75	2	160	1	235	35 540	170	1	320	1	490	77 905
IUPAC # 74	23	2	56	1	79	12 741	19	1	24	8	43	6 503	26	2	120	1	146	23 212
IUPAC # 70 '	68	1	160	2	228	36 770	57	1	210	8	267	40 379	68	2	250	1	318	50 559
Pentachlorobiphényles																		
IUPAC # 95	86	4	160	3	246	39 673	94	2	330	20	424	64 123	ND	2	230	1	230	36 567
IUPAC # 101	52	6	260	3	312	50 317	67	10	490	20	557	84 237	29	5	310	1	339	53 897
IUPAC # 99	42	4	79	3	121	19 514	39	3	140	20	179	27 071	ND	4	94	1	94	14 945
IUPAC # 87	51	5	99	3	150	24 191	45	4	150	20	195	29 491	35	4	110	1	145	23 053
IUPAC # 110	120	1	230	3	350	56 446	100	2	350	20	450	68 055	79	1	300	1	379	60 257
IUPAC # 82	NDR	2	28	3	28	4 516	13	3	43	20	56	8 469	9	1	24	1	33	5 247
IUPAC # 118	97	3	180	3	277	44 673	82	2	240	10	322	48 697	60	1	230	1	290	46 107
IUPAC # 105	32	2	57	2	89	14 353	24	2	85	10	109	16 485	20	1	71	1	91	14 468
Hexachlorobiphényles											0							
IUPAC # 151	18	4	NDR	1	18	2 903	17	5	51	2	68	10 284	11	2	43	1	54	8 585
IUPAC # 149	70	3	190	1	260	41 931	67	2	170	2	237	35 842	44	1	230	1	274	43 563
IUPAC # 153 + 132	110	2	235	1	345	55 640	88	3	245	2	333	50 361	61	1	278	1	339	53 897
IUPAC # 138 + 158 '	79	4	270	1	349	56 285	67	5	230	2	297	44 916	48	2	301	1	349	55 487
IUPAC # 128	17	5	42	1	59	9 515	14	5	45	1	59	8 923	12	1	57	1	69	10 970
IUPAC # 156	7	2	20	1	27	4 354	NDR	2	23	3	23	3 478	5	1	25	1	30	4 770
Heptachlorobiphényles																		
IUPAC # 187 '	19	5	47	1	66	10 644	NDR	10	NDR	2	0	0	NDR	4	42	1	42	6 678
IUPAC # 183	DNQ	7	16	1	16	2 580	ND	8	NDR	2	0	0	DNQ	3	20	1	20	3 180
IUPAC # 177	ND	4	19	1	19	3 064	DNQ	7	21	3	21	3 176	NDR	2	22	1	22	3 498
IUPAC # 171	ND	2	NDR	1	0	0	ND	5	DNQ	3	0	0	NDR	3	16	1	16	2 544
IUPAC # 180	NDR	3	91	1	91	14 676	27	3	100	2	127	19 207	15	1	85	1	100	15 899
IUPAC # 191 '	ND	4	DNQ	1	0	0	NDR	5	NDR	2	0	0	NDR	1	ND	1	0	0
IUPAC # 170 '	DNQ	4	10	1	10	1 613	17	2	40	3	57	8 620	8	2	46	1	54	8 585
Octachlorobiphényles																		
IUPAC # 199	NDR	2	NDR	1	0	0	DNQ	3	NDR	1	0	0	NDR	1	17	1	17	2 703
IUPAC # 195	ND	1	6	1	6	968	ND	4	DNQ	1	0	0	ND	2	NDR	1	0	0
IUPAC # 194	DNQ	2	NDR	1	0	0	NDR	3	19	1	19	2 873	ND	1	14	1	14	2 226
IUPAC # 205	ND	1	ND	1	0	0	ND	1	ND	1	0	0	DNQ	1	DNQ	1	0	0
Nonachlorobiphényles																		

CUQ (station Est) - HIVER 97

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1997/01/06-07)						Jour 3 (1997/01/08-09)						Jour 5 (1997/01/10-11)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
IUPAC # 208	NDR	1	4	1	4	645	ND	1	DNQ	1	0	0	NDR	1	NDR	1	0	0
IUPAC # 206	ND	2	NDR	1	0	0	ND	2	9	1	9	1 361	ND	1	NDR	1	0	0
Décachlorobiphényles																		
IUPAC # 209	ND	1	ND	1	0	0	ND	1	7	1	7	1 059	DNQ	1	NDR	1	0	0
Total (Σ 43 congénères)	1 644		3 021		4 665	752 406	1 582		4 407		5 989	905 680	2 543		5 515		8 058	1 281 197

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1997/01/06-07)						Jour 3 (1997/01/08-09)						Jour 5 (1997/01/10-11)					
Groupes homologues	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dichlorobiphényles	490	1			490	79 024	430	1			430	65 031	1100	1			1100	174 888
Trichorobiphényles	660	1	1100	1	1760	283 842	670	1	1100	1	1770	267 684	2100	1	1700	1	3800	604 158
Tétrachlorobiphényles	660	1	1700	1	2360	380 607	580	1	980	1	1560	235 925	1000	1	1700	1	2700	429 270
Pentachlorobiphényles	610	1	1300	2	1910	308 033	530	1	2000	10	2530	382 622	290	1	1500	1	1790	284 590
Hexachlorobiphényles	350	1	980	1	1330	214 494	330	1	930	1	1260	190 555	230	1	1000	1	1230	195 556
Heptachlorobiphényles	19	1	230	1	249	40 157	44	1	240	2	284	42 950	24	1	270	1	294	46 743
Octachlorobiphényles	ND	1	6	1	6	968	ND	1	30	1	30	4 537	ND	1	31	1	31	4 929
Nonachlorobiphényles	ND	1	4	1	4	645	ND	1	9	1	9	1 361	ND	1	ND	1	0	0
Décachlorobiphényles	ND	1	ND	1	0	0	ND	1	7	1	7	1 059	DNQ	1	NDR	1	0	0
Total	2 789		5 320		8 109	1 307 771	2 584		5 296		7 880	1 191 724	4 744		6 201		10 945	1 740 135
Nombre de congénères	49		70				52		59				56		67			

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique; Une case vide indiqe que le groupe homologue n'a pas été analysé.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

COOKSHIRE - HIVER 97

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1997/02/03)						Jour 3 (1997/02/05)						Jour 5 (1997/02/07)[illegible]					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Planaires																		
IUPAC # 77	35	0,2	18	0,1	53	64	34	0,1	18	0,1	52	66	36	0,02	19	0,2	55	69
IUPAC # 126	ND	0,4	0,9	0,1	0,9	1	ND	0,4	ND	0,3	0	0	ND	0,04	ND	0,4	0	0
IUPAC # 169	ND	0,3	ND	0,1	0	0	ND	0,2	ND	0,1	0	0	ND	0,02	ND	0,2	0	0
Trichlorobiphényles																		
IUPAC # 18	640	4	470	2	1110	1 346	650	3	430	1	1080	1 380	650	4				
IUPAC # 17	230	3	150	2	380	461	210	3	390	1	600	767	220	3				
IUPAC # 31 + 28	1100	8	1330	1	2430	2 948	1000	10	1140	1	2140	2 735	1100	5				
IUPAC # 33 [1]	480	20	450	1	930	1 128	430	10	450	1	880	1 125	450	10				
Tétrachlorobiphényles																		
IUPAC # 52	670	4	950	1	1620	1 965	610	6	970	1	1580	2 019	660	5				
IUPAC # 49 [1]	240	4	340	1	580	704	210	8	330	1	540	690	230	5				
IUPAC # 44 [1]	390	9	360	1	750	910	420	6	390	1	810	1 035	410	5				
IUPAC # 74	130	7	130	20	260	315	110	8	170	9	280	358	120	10				
IUPAC # 70 [1]	430	5	400	20	830	1 007	390	5	430	9	820	1 048	420	9				
Pentachlorobiphényles																		
IUPAC # 95	660	9	1300	10	1960	2 377	620	8	1400	10	2020	2 582	690	10				
IUPAC # 101	720	40	2300	10	3020	3 663	730	30	2400	9	3130	4 000	790	30				
IUPAC # 99	280	30	740	9	1020	1 237	270	30	680	9	950	1 214	330	20				
IUPAC # 87	470	50	610	10	1080	1 310	380	40	720	10	1100	1 406	440	40				
IUPAC # 110	830	30	1300	9	2130	2 584	770	30	1500	8	2270	2 901	850	30				
IUPAC # 82	170	60	NDR	10	170	206	130	40	86	10	216	276	DNQ	60				
IUPAC # 118	620	70	1000	8	1620	1 965	600	40	1100	8	1700	2 173	650	60				
IUPAC # 105	ND	100	290	7	290	352	ND	60	310	7	310	396	ND	30				
Hexachlorobiphényles																		
IUPAC # 151	100	30	210	1	310	376	84	20	250	1	334	427	110	20				
IUPAC # 149	520	50	770	1	1290	1 565	370	30	860	1	1230	1 572	470	30				
IUPAC # 153 + 132	690	90	880	1	1570	1 904	520	30	1150	1	1670	2 134	580	20				
IUPAC # 138 + 158 [1]	ND	80	907	1	907	1 100	ND	40	1200	1	1200	1 534	ND	60				
IUPAC # 128	ND	30	210	1	210	255	NDR	90	230	1	230	294	NDR	70				
IUPAC # 156	ND	10	73	10	73	89	ND	20	98	10	98	125	ND	20				
Heptachlorobiphényles																		
IUPAC # 187 [1]	ND	30	150	1	150	182	DNQ	70	140	1	140	179	NDR	60				
IUPAC # 183	ND	30	NDR	1	0	0	ND	70	49	1	49	63	ND	60				
IUPAC # 177	ND	30	47	7	47	57	ND	70	62	10	62	79	ND	60				
IUPAC # 171	ND	30	35	8	35	42	ND	70	NDR	20	0	0	ND	70				
IUPAC # 180	ND	30	NDR	7	0	0	DNQ	50	330	10	330	422	ND	60				
IUPAC # 191 [1]	ND	30	ND	6	0	0	ND	70	ND	10	0	0	ND	60				
IUPAC # 170 [1]	ND	30	NDR	7	0	0	ND	70	120	10	120	153	ND	60				
Octachlorobiphényles																		
IUPAC # 199	ND	20	42	1	42	51	ND	40	46	1	46	59	ND	30				
IUPAC # 195	ND	30	DNQ	6	0	0	ND	3	NDR	7	0	0	ND	30				
IUPAC # 194	ND	20	50	6	50	61	ND	10	NDR	7	0	0	1	30				
IUPAC # 205	ND	30	39	5	39	47	ND	5	ND	5	0	0	ND	30				
Nonachlorobiphényles																		

COOKSHIRE - HIVER 97

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1997/02/03)						Jour 3 (1997/02/05)						Jour 5 (1997/02/07)[note]					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
IUPAC # 208	ND	10	ND	1	0	0	NDR	5	NDR	3	0	0	ND	10				
IUPAC # 206	ND	10	NDR	1	0	0	ND	5	NDR	4	0	0	ND	10				
Décachlorobiphényles																		
IUPAC # 209	ND	10	NDR	1	0	0	DNQ	2	NDR	1	0	0	ND	20				
Total (Σ 43 congénères)	9 405		15 552		24 957	30 273	8 538		17 449		25 987	33 211	9 207		19		55	69

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1997/02/03)						Jour 3 (1997/02/05)						Jour 5 (1997/02/07)[1]					
Groupes homologues	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dichlorobiphényles	1500	3			1500	1 820	1300	3			1300	1 661	1400	3				
Trichorobiphényles	3300	3	3100	1	6400	7 763	3100	3	3000	1	6100	7 796	3200	3				
Tétrachlorobiphényles	3900	4	3400	1	7300	8 855	3100	5	3600	1	6700	8 563	3600	5				
Pentachlorobiphényles	4500	9	8300	7	12800	15 526	4100	8	9100	7	13200	16 870	4600	10				
Hexachlorobiphényles	1300	10	3500	1	4800	5 822	1000	20	4300	1	5300	6 773	1300	20				
Heptachlorobiphényles	ND	30	420	1	420	509	ND	50	1000	1	1000	1 278	ND	60				
Octachlorobiphényles	ND	20	170	1	170	206	ND	3	70	1	70	89	ND	30				
Nonachlorobiphényles	ND	10	ND	1	0	0	ND	5	15	3	15	19	ND	10				
Décachlorobiphényles	ND	10	NDR	1	0	0	DNQ	2	NDR	1	0	0	ND	20				
Total	**14 500**		**18 890**		**33 390**	**40 502**	**12 600**		**21 085**		**33 685**	**43 049**	**14 100**					
Nombre de congénères	**44**		**76**				**44**		**73**				**47**					

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique; Une case vide indiqe que le groupe homologue n'a pas été analysé.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres

Note : échantillon de la fraction particulaire perdu pour le jour 5.

FARNHAM - HIVER 97

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1997/02/10-11)						Jour 3 (1997/02/12-13)						Jour 5 (1997/02/14-15)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Planaires																		
IUPAC # 77	4,5	0,1	3,1	0,1	7,6	98	7,8	0,1	2,9	0,1	10,7	136	9,3	0,1	3	0,1	12,3	161
IUPAC # 126	DNQ	0,4	3,5	0,3	3,5	45	ND	0,7	DNQ	3	0	0	ND	0,9	DNQ	7	0	0
IUPAC # 169	DNQ	0,3	0,3	0,1	0,3	4	ND	0,6	ND	0,1	0	0	ND	0,5	ND	0,1	0	0
Trichlorobiphényles																		
IUPAC # 18	120	2	18	1	138	1 782	210	3	29	1	239	3 047	330	3	71	1	401	5 253
IUPAC # 17	48	2	8	1	56	723	80	3	11	1	91	1 160	120	3	186	1	306	4 008
IUPAC # 31 + 28	177	2	51	1	228	2 944	340	3	74	1	414	5 279	500	3	98	1	598	7 833
IUPAC # 33 [1]	48	2	16	1	64	826	96	2	27	1	123	1 568	160	2	33	1	193	2 528
Tétrachlorobiphényles																		
IUPAC # 52	120	1	36	1	156	2 015	270	1	47	1	317	4 042	300	1	66	1	366	4 794
IUPAC # 49 [1]	54	1	16	1	70	904	120	1	22	1	142	1 811	140	1	32	1	172	2 253
IUPAC # 44 [1]	59	1	20	1	79	1 020	130	1	29	1	159	2 027	160	1	37	1	197	2 581
IUPAC # 74	20	2	8	1	28	362	43	2	10	1	53	676	50	2	7	3	57	747
IUPAC # 70 [1]	59	2	27	1	86	1 111	130	2	36	1	166	2 117	140	2	49	3	189	2 476
Pentachlorobiphényles																		
IUPAC # 95	180	5	71	1	251	3 241	330	7	64	1	394	5 024	330	6	85	5	415	5 436
IUPAC # 101	220	4	130	1	350	4 520	430	6	110	1	540	6 885	490	6	130	4	620	8 121
IUPAC # 99	46	4	15	1	61	788	110	6	20	1	130	1 658	120	5	31	4	151	1 978
IUPAC # 87	66	5	27	1	93	1 201	140	7	34	1	174	2 219	170	6	37	5	207	2 711
IUPAC # 110	160	4	73	1	233	3 009	330	6	77	1	407	5 189	420	5	80	4	500	6 550
IUPAC # 82	19	5	8	1	27	349	31	7	6	1	37	472	40	6	DNQ	5	40	524
IUPAC # 118	120	4	58	1	178	2 299	240	5	52	1	292	3 723	250	5	63	4	313	4 100
IUPAC # 105	41	4	18	1	59	762	92	5	20	1	112	1 428	120	5	18	4	138	1 808
Hexachlorobiphényles																		
IUPAC # 151	50	3	97	1	147	1 898	46	5	38	1	84	1 071	46	5	30	2	76	996
IUPAC # 149	150	3	330	1	480	6 199	160	5	130	1	290	3 698	170	5	110	2	280	3 668
IUPAC # 153 + 132	196	4	350	1	546	7 051	220	6	194	1	414	5 279	228	6	116	2	344	4 506
IUPAC # 138 + 158 [1]	195	3	475	1	670	8 652	212	5	179	1	391	4 985	272	5	146	2	418	5 475
IUPAC # 128	36	5	33	1	69	891	73	10	19	1	92	1 173	92	10	NDR	1	92	1 205
IUPAC # 156	11	2	33	1	44	568	26	3	12	1	38	485	17	3	14	3	31	406
Heptachlorobiphényles																		
IUPAC # 187 [1]	61	5	160	1	221	2 854	65	10	76	1	141	1 798	84	10	32	2	116	1 519
IUPAC # 183	29	5	69	1	98	1 266	DNQ	10	33	1	33	421	35	10	17	2	52	681
IUPAC # 177	26	8	89	1	115	1 485	DNQ	10	40	2	40	510	ND	20	26	3	26	341
IUPAC # 171	DNQ	8	43	1	43	555	DNQ	10	16	2	16	204	ND	20	11	3	11	144
IUPAC # 180	120	7	470	1	590	7 619	140	10	190	2	330	4 208	120	20	130	2	250	3 275
IUPAC # 191 [1]	ND	6	7	1	7	90	ND	10	DNQ	1	0	0	ND	10	ND	2	0	0
IUPAC # 170 [1]	49	8	210	1	259	3 345	57	10	81	2	138	1 760	DNQ	20	67	3	67	878
Octachlorobiphényles																		
IUPAC # 199	24	6	70	1	94	1 214	49	10	NDR	1	49	625	61	10	19	1	80	1 048
IUPAC # 195	ND	5	32	1	32	413	ND	10	13	1	13	166	ND	20	11	1	11	144
IUPAC # 194	22	5	110	1	132	1 705	43	10	47	1	90	1 148	DNQ	10	50	1	50	655
IUPAC # 205	ND	4	5	1	5	65	ND	10	DNQ	1	0	0	ND	10	2	1	2	26
Nonachlorobiphényles																		

FARNHAM - HIVER 97

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1997/02/10-11)						Jour 3 (1997/02/12-13)						Jour 5 (1997/02/14-15)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
IUPAC # 208	ND	5	8	1	8	103	ND	9	7	1	7	89	DNQ	9	10	1	10	131
IUPAC # 206	DNQ	7	51	1	51	659	NDR	10	36	1	36	459	42	10	53	2	95	1 244
Décachlorobiphényles																		
IUPAC # 209	ND	4	5	1	5	65	ND	10	7	1	7	89	ND	8	7	2	7	92
Total (Σ 43 congénères)	2 531		3 254		5 784	74 700	4 221		1 789		6 010	76 624	5 016		1 877		6 893	90 295

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1997/02/10-11)						Jour 3 (1997/02/12-13)						Jour 5 (1997/02/14-15)					
Groupes homologues	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Trichorobiphényles	550	2	120	1	670	8 652	940	2	200	1	1140	14 535	1500	2	430	1	1930	25 281
Tétrachlorobiphényles	620	1	190	1	810	10 460	1300	1	250	1	1550	19 763	1500	1	330	1	1830	23 971
Pentachlorobiphényles	910	4	450	1	1360	17 563	1800	5	430	1	2230	28 433	2200	5	460	4	2660	34 843
Hexachlorobiphényles	790	2	1600	1	2390	30 864	770	3	660	1	1430	18 233	1000	3	470	1	1470	19 256
Heptachlorobiphényles	320	5	1300	1	1620	20 921	260	10	580	1	840	10 710	240	10	360	2	600	7 859
Octachlorobiphényles	75	4	260	1	335	4 326	140	10	84	1	224	2 856	120	10	87	1	207	2 711
Nonachlorobiphényles	ND	5	59	1	59	762	ND	9	47	1	47	599	42	9	67	1	109	1 428
Décachlorobiphényles	ND	4	5	1	5	65	ND	10	7	1	7	89	ND	8	7	2	7	92
Total	**3 265**		**3 984**		**7 249**	**93 614**	**5 210**		**2 258**		**7 468**	**95 217**	**6 602**		**2 211**		**8 813**	**115 441**
Nombre de congénères	58		78				50		78				65		62			

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique; Une case vide indiqe que le groupe homologue n'a pas été analysé.

' : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

LA PRAIRIE - HIVER 96

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1996/12/02-03)						Jour 3 (1996/12/04-05)						Jour 5 (1996/12/06-07)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Planaires																		
IUPAC # 77	1,8	0,01	6,1	0,03	7,9	398	2,4	0,01	8,4	0,02	10,8	529	2,4	0,02	14	0,01	16,4	744
IUPAC # 126	DNQ	0,03	0,2	0,05	0,2	10	0,23	0,03	ND	0,9	0,23	11	ND	0,1	NDR	0,03	0	0
IUPAC # 169	DNQ	0,02	ND	0,03	0	0	ND	0,02	ND	0,02	0	0	DNQ	0,02	NDR	0,01	0	0
Trichlorobiphényles																		
IUPAC # 18	340	1	86	1	426	21 442	390	1	120	1	510	24 985	350	1	190	1	540	24 492
IUPAC # 17	120	1	31	1	151	7 600	110	1	48	1	158	7 740	120	1	73	1	193	8 754
IUPAC # 31 + 28	340	1	160	1	500	25 167	380	2	260	1	640	31 354	350	2	410	2	760	34 471
IUPAC # 33 '	NDR	4	14	2	14	705	18	4	11	2	29	1 421	12	3	13	3	25	1 134
Tétrachlorobiphényles																		
IUPAC # 52	160	1	140	1	300	15 100	190	1	160	1	350	17 147	160	1	280	2	440	19 957
IUPAC # 49 '	55	1	67	1	122	6 141	69	1	81	1	150	7 349	55	1	130	3	185	8 391
IUPAC # 44 '	86	1	92	1	178	8 959	82	1	96	1	178	8 720	83	1	180	2	263	11 929
IUPAC # 74	14	1	26	2	40	2 013	18	1	39	2	57	2 792	20	1	71	3	91	4 127
IUPAC # 70 '	47	1	88	1	135	6 795	58	1	110	1	168	8 230	65	1	200	2	265	12 019
Pentachlorobiphényles																		
IUPAC # 95	64	2	140	1	204	10 268	71	1	160	1	231	11 317	74	3	260	2	334	15 149
IUPAC # 101	47	2	250	4	297	14 949	48	2	220	4	268	13 129	64	2	550	9	614	27 849
IUPAC # 99	24	1	85	9	109	5 486	30	4	100	8	130	6 369	32	4	190	8	222	10 069
IUPAC # 87	24	2	91	6	115	5 788	32	1	100	4	132	6 467	35	2	180	20	215	9 752
IUPAC # 110	61	1	200	1	261	13 137	71	1	230	1	301	14 746	84	1	430	1	514	23 313
IUPAC # 82	DNQ	2	NDR	1	0	0	6	1	23	1	29	1 421	7	1	45	1	52	2 359
IUPAC # 118	36	2	150	1	186	9 362	40	1	200	1	240	11 758	45	2	350	5	395	17 916
IUPAC # 105	12	1	52	1	64	3 221	14	1	71	1	85	4 164	19	1	120	2	139	6 304
Hexachlorobiphényles																		
IUPAC # 151	9	1	48	1	57	2 869	6	1	26	1	32	1 568	6	1	54	1	60	2 721
IUPAC # 149	31	1	160	2	191	9 614	24	1	100	2	124	6 075	24	1	210	2	234	10 613
IUPAC # 153 + 132	39	1	300	1	339	17 063	27	1	180	1	207	10 141	33	1	380	1	413	18 732
IUPAC # 138 + 158 '	29	1	160	2	189	9 513	27	1	130	10	157	7 691	25	1	260	30	285	12 926
IUPAC # 128	5	1	31	1	36	1 812	5	1	37	1	42	2 058	5	1	66	2	71	3 220
IUPAC # 156	DNQ	1	13	1	13	654	DNQ	1	15	1	15	735	DNQ	1	25	1	25	1 134
Heptachlorobiphényles																		
IUPAC # 187 '	NDR	3	71	3	71	3 574	ND	3	NDR	2	0	0	DNQ	2	NDR	2	0	0
IUPAC # 183	NDR	2	36	2	36	1 812	ND	1	NDR	1	0	0	ND	2	NDR	2	0	0
IUPAC # 177	NDR	2	NDR	1	0	0	NDR	1	NDR	1	0	0	NDR	3	NDR	3	0	0
IUPAC # 171	DNQ	1	NDR	1	0	0	ND	1	ND	1	0	0	DNQ	1	NDR	1	0	0
IUPAC # 180	NDR	1	160	1	160	8 053	5	1	35	1	40	1 960	7	1	93	1	100	4 536
IUPAC # 191 '	ND	1	DNQ	1	0	0	ND	1	ND	1	0	0	ND	1	NDR	1	0	0
IUPAC # 170 '	DNQ	2	56	1	56	2 819	4	1	15	1	19	931	4	1	35	1	39	1 769
Octachlorobiphényles																		
IUPAC # 199	ND	1	24	1	24	1 208	ND	1	ND	1	0	0	ND	1	13	1	13	590
IUPAC # 195	ND	1	11	1	11	554	ND	1	ND	1	0	0	ND	1	4	1	4	181
IUPAC # 194	NDR	2	27	1	27	1 359	NDR	1	8	1	8	392	NDR	1	16	1	16	726
IUPAC # 205	ND	1	NDR	1	0	0	ND	1	1	1	1	49	ND	1	ND	1	0	0
Nonachlorobiphényles																		

LA PRAIRIE - HIVER 96

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1996/12/02-03)						Jour 3 (1996/12/04-05)						Jour 5 (1996/12/06-07)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)
IUPAC # 208	DNQ	1	NDR	1	0	0	NDR	1	2	1	2	98	NDR	1	DNQ	1	0	0
IUPAC # 206	NDR	1	5	1	5	252	NDR	1	ND	1	0	0	ND	1	4	1	4	181
Décachlorobiphényles																		
IUPAC # 209	ND	1	ND	1	0	0	ND	1	ND	1	0	0	ND	1	ND	1	0	0
Total (Σ 43 congénères)	1 545		2 780		4 325	217 695	1 728		2 586		4 314	211 344	1 681		4 846		6 527	296 057

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1996/12/02-03)						Jour 3 (1996/12/04-05)						Jour 5 (1996/12/06-07)					
Groupes homologues	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/l)
Dichlorobiphényles	140	1	29	1	169	8 506	130	1	37	1	167	8 181	150	1	36	1	186	8 436
Trichorobiphényles	1 100	1	420	1	1 520	76 506	1 200	1	630	1	1 830	89 652	1 100	1	960	1	2 060	93 433
Tétrachlorobiphényles	620	1	740	1	1 360	68 453	710	1	790	1	1 500	73 485	670	1	1 700	1	2 370	107 494
Pentachlorobiphényles	300	1	1 100	1	1 400	70 466	380	1	1 300	1	1 680	82 303	430	1	2 500	1	2 930	132 893
Hexachlorobiphényles	140	1	930	1	1 070	53 856	120	1	660	1	780	38 212	110	1	1 300	1	1 410	63 952
Heptachlorobiphényles	ND	1	450	1	450	22 650	9	1	75	1	84	4 115	11	1	200	1	211	9 570
Octachlorobiphényles	ND	1	110	1	110	5 537	ND	1	14	1	14	686	ND	1	69	1	69	3 130
Nonachlorobiphényles	ND	1	5	1	5	252	ND	1	2	1	2	98	ND	1	6	1	6	272
Décachlorobiphényles	ND	1	ND	1	0	0	ND	1	ND	1	0	0	ND	1	ND	1	0	0
Total	**2 300**		**3 784**		**6 084**	**306 226**	**2 549**		**3 508**		**6 057**	**296 732**	**2 471**		**6 771**		**9 242**	**419 180**
Nombre de congénères	46		68				56		71				51		78			

ND : non détecté;   DNQ : détecté non quantifié;   NDR : détecté mais ne satisfait pas le rapport isotopique.   Une case vide indiqe que le groupe homologue n'a pas été analysé.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

LONGUEUIL - HIVER 96

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1996/12/09-10)						Jour 3 (1996/12/11-12)						Jour 5 (1996/12/13-14)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Planaires																		
IUPAC # 77	0,64	0,04	6,7	0,02	7,34	2 356	0,37	0,01	9,1	0,02	9,47	2 803	0,38	0,02	7,6	0,02	7,98	2 586
IUPAC # 126	ND	0,06	DNQ	0,1	0	0	DNQ	0,04	ND	0,05	0	0	ND	0,2	ND	0,2	0	0
IUPAC # 169	DNQ	0,05	0,13	0,03	0,13	42	ND	0,02	ND	0,02	0	0	DNQ	0,03	ND	0,03	0	0
Trichlorobiphényles																		
IUPAC # 18	95	1	90	1	185	59 385	69	1	110	1	179	52 984	74	1	4	1	78	25 272
IUPAC # 17	34	1	35	1	69	22 149	25	1	40	1	65	19 240	28	1	NDR	1	28	9 072
IUPAC # 31 + 28	98	2	200	1	298	95 658	76	1	230	1	306	90 576	71	1	150	1	221	71 604
IUPAC # 33 '	37	2	77	3	114	36 594	28	2	100	2	128	37 888	29	3	ND	1	29	9 396
Tétrachlorobiphényles																		
IUPAC # 52	27	2	120	1	147	47 187	18	2	140	1	158	46 768	26	1	98	1	124	40 176
IUPAC # 49 '	13	1	54	1	67	21 507	NDR	2	63	1	63	18 648	33	1	46	1	79	25 596
IUPAC # 44 '	16	2	89	1	105	33 705	11	3	110	1	121	35 816	14	1	57	1	71	23 004
IUPAC # 74	4	1	36	2	40	12 840	DNQ	1	50	4	50	14 800	DNQ	1	25	1	25	8 100
IUPAC # 70 '	12	1	110	2	122	39 162	8	1	140	2	148	43 808	9	1	66	1	75	24 300
Pentachlorobiphényles																		
IUPAC # 95	16	1	150	1	166	53 286	11	2	170	1	181	53 576	19	1	180	1	199	64 476
IUPAC # 101	12	2	300	4	312	100 152	11	1	320	6	331	97 976	18	1	290	3	308	99 792
IUPAC # 99	5	1	63	6	68	21 828	DNQ	2	74	7	74	21 904	5	1	49	5	54	17 496
IUPAC # 87	8	2	79	9	87	27 927	DNQ	3	88	8	88	26 048	6	2	73	4	79	25 596
IUPAC # 110	17	1	170	1	187	60 027	10	2	200	2	210	62 160	14	1	180	1	194	62 856
IUPAC # 82	DNQ	2	20	1	20	6 420	ND	1	NDR	2	0	0	ND	1	13	1	13	4 212
IUPAC # 118	15	3	140	1	155	49 755	10	2	160	2	170	50 320	11	2	120	2	131	42 444
IUPAC # 105	6	2	47	1	53	17 013	4	1	53	2	57	16 872	NDR	2	41	1	41	13 284
Hexachlorobiphényles																		
IUPAC # 151	DNQ	2	130	1	130	41 730	DNQ	3	130	2	130	38 480	5	1	190	1	195	63 180
IUPAC # 149	14	1	340	1	354	113 634	10	1	350	2	360	106 560	16	1	510	2	526	170 424
IUPAC # 153 + 132	21	1	530	1	551	176 871	16	1	530	1	546	161 616	20	1	790	1	810	262 440
IUPAC # 138 + 158 '	17	1	260	10	277	88 917	10	1	280	1	290	85 840	14	1	450	10	464	150 336
IUPAC # 128	DNQ	2	35	2	35	11 235	NDR	1	42	3	42	12 432	DNQ	1	46	4	46	14 904
IUPAC # 156	NDR	1	20	3	20	6 420	NDR	1	26	3	26	7 696	ND	1	32	6	32	10 368
Heptachlorobiphényles																		
IUPAC # 187 '	ND	4	200	5	200	64 200	ND	1	NDR	5	0	0	DNQ	2	300	5	300	97 200
IUPAC # 183	ND	1	NDR	3	0	0	ND	1	NDR	4	0	0	ND	1	160	3	160	51 840
IUPAC # 177	ND	1	NDR	5	0	0	NDR	1	NDR	2	0	0	NDR	2	NDR	3	0	0
IUPAC # 171	ND	1	NDR	2	0	0	1	1	NDR	4	1	296	DNQ	1	NDR	3	0	0
IUPAC # 180	NDR	1	380	1	380	121 980	NDR	1	360	1	360	106 560	7	1	660	1	667	216 108
IUPAC # 191 '	ND	1	7	1	7	2 247	ND	1	7	2	7	2 072	NDR	1	10	1	10	3 240
IUPAC # 170 '	DNQ	1	110	1	110	35 310	DNQ	1	120	2	120	35 520	4	1	280	1	284	92 016
Octachlorobiphényles																		
IUPAC # 199	ND	1	65	1	65	20 865	ND	1	74	1	74	21 904	DNQ	1	120	1	120	38 880
IUPAC # 195	ND	1	18	1	18	5 778	ND	1	19	1	19	5 624	ND	1	45	1	45	14 580
IUPAC # 194	NDR	1	67	1	67	21 507	DNQ	1	78	1	78	23 088	NDR	1	140	1	140	45 360
IUPAC # 205	ND	1	3	1	3	963	ND	1	DNQ	1	0	0	ND	1	6	1	6	1 944
Nonachlorobiphényles																		

LONGUEUIL - HIVER 96

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1996/12/09-10)						Jour 3 (1996/12/11-12)						Jour 5 (1996/12/13-14)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
IUPAC # 208	1	1	NDR	1	1	321	ND	1	NDR	1	0	0	NDR	1	NDR	1	0	0
IUPAC # 206	ND	1	17	1	17	5 457	ND	1	26	2	26	7 696	ND	1	21	1	21	6 804
Décachlorobiphényles																		
IUPAC # 209	ND	1	DNQ	1	0	0	ND	1	ND	1	0	0	ND	1	DNQ	1	0	0
Total (Σ 43 congénères)	469		3 969		4 437	1 424 428	318		4 099		4 417	1 307 571	423		5 160		5 583	1 808 886

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1996/12/09-10)						Jour 3 (1996/12/11-12)						Jour 5 (1996/12/13-14)					
Groupes homologues	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dichlorobiphényles	260	1	110	1	370	118 770	190	1	120	1	310	91 760	220	1	3	1	223	72 252
Trichorobiphényles	340	1	520	1	860	276 060	250	1	650	1	900	266 400	250	1	210	1	460	149 040
Tétrachlorobiphényles	190	1	690	1	880	282 480	86	1	870	1	956	282 976	130	1	440	1	570	184 680
Pentachlorobiphényles	80	1	1100	1	1180	378 780	46	1	1200	1	1246	368 816	73	1	1100	1	1173	380 052
Hexachlorobiphényles	58	1	1800	11	1858	596 418	36	1	1800	1	1836	543 456	56	1	2700	1	2756	892 944
Heptachlorobiphényles	ND	1	1000	1	1000	321 000	1	1	860	1	861	254 856	11	1	1900	1	1911	619 164
Octachlorobiphényles	ND	1	260	1	260	83 460	ND	1	280	1	280	82 880	ND	1	550	1	550	178 200
Nonachlorobiphényles	1	1	17	1	18	5 778	ND	1	26	1	26	7 696	ND	1	22	1	22	7 128
Décachlorobiphényles	ND	1	DNQ	1	0	0	ND	1	ND	1	0	0	ND	1	DNQ	1	0	0
Total	929		5 497		6 426	2 062 746	609		5 806		6 415	1 898 840	740		6 925		7 665	2 483 460
Nombre de congénères	39		78				32		74				33		68			

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique; Une case vide indiqe que le groupe homologue n'a pas été analysé.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres

MARTINVILLE - HIVER 99

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1999/05/31)			Jour 3 (1999/06/02)			Jour 5 (1999/06/04)		
Congénères	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Planaires									
IUPAC # 77	4,5	0,1	8	4,6	0,1	7	2,5	0,1	4
IUPAC # 126	ND	0,2	0	ND	0,2	0	ND	0,2	0
IUPAC # 169	ND	0,1	0	NDR	0,07	0	ND	0,06	0
Trichlorobiphényles									
IUPAC # 18	110	10	200	160	5	249	110	6	161
IUPAC # 17	41	10	75	58	4	90	37	5	54
IUPAC # 31 + 28	280	10-8	510	360	4	561	224	5	327
IUPAC # 33 [1]	120	9	219	140	4	218	84	4	123
Tétrachlorobiphényles									
IUPAC # 52	140	2	255	140	0,5	218	90	0,4	132
IUPAC # 49 [1]	75	2	137	94	0,7	147	56	0,5	82
IUPAC # 44 [1]	69	2	126	88	0,6	137	51	0,5	75
IUPAC # 74	19	4	35	30	3	47	15	0,5	22
IUPAC # 70 [1]	43	3	78	76	3	118	31	0,5	45
Pentachlorobiphényles									
IUPAC # 95	62	3	113	82	2	128	42	1	61
IUPAC # 101	92	3	168	120	2	187	58	1	85
IUPAC # 99	35	3	64	44	2	69	19	1	28
IUPAC # 87	33	3	60	48	3	75	21	2	31
IUPAC # 110	48	2	87	60	1	94	23	0,8	34
IUPAC # 82	ND	4	0	12	3	19	DNQ	2	0
IUPAC # 118	33	2	60	39	1	61	16	0,8	23
IUPAC # 105	14	2	25	16	2	25	7,9	1	12
Hexachlorobiphényles									
IUPAC # 151	24	2	44	31	0,6	48	15	0,6	22
IUPAC # 149	79	2	144	79	0,6	123	33	0,6	48
IUPAC # 153 + 132	73	1-2	133	97	0,7	151	45	0,7	66
IUPAC # 138 + 158 [1]	53	2-1	97	70,5	0,6	110	26,6	0,6	39
IUPAC # 128	8	2	15	9,1	0,6	14	4,8	0,7	7
IUPAC # 156	DNQ	2	0	ND	0,8	0	ND	0,8	0
Heptachlorobiphényles									
IUPAC # 187 [1]	21	1	38	27	0,5	42	9,3	0,4	14
IUPAC # 183	8	1	15	12	0,5	19	5,1	0,4	7
IUPAC # 177	DNQ	5	0	10	2	16	4,7	1	7
IUPAC # 171	DNQ	5	0	DNQ	2	0	ND	1	0
IUPAC # 180	24	4	44	22	1	34	7,8	1	11
IUPAC # 191 [1]	ND	3	0	ND	1	0	ND	1	0
IUPAC # 170 [1]	DNQ	5	0	8,9	2	14	4,3	1	6
Octachlorobiphényles									
IUPAC # 199	12	1	22	8,1	0,4	13	3,9	0,5	6
IUPAC # 195	3	1	5	ND	0,7	0	1,6	0,5	2
IUPAC # 194	8	1	15	DNQ	0,7	0	DNQ	0,5	0
IUPAC # 205	ND	1	0	ND	0,6	0	ND	0,4	0
Nonachlorobiphényles									
IUPAC # 208	ND	1	0	DNQ	0,5	0	DNQ	0,4	0
IUPAC # 206	NDR	1	0	6	0,7	9	2,8	0,5	4
Décachlorobiphényles									
IUPAC # 209	2,7	1	5	ND	0,5	0	ND	0,3	0
Total (Σ 43 congénères)	1 534		2 794	1 952		3 043	1 051		1 536

ND : non détecté; DNQ : détecté non quantifié, NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres

MARTINVILLE - HIVER 99

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1999/05/31)			Jour 3 (1999/06/02)			Jour 5 (1999/06/04)		
Groupes homologues	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	650	8	1184	1000	3	1 559	620	3	906
Tétrachlorobiphényles	700	2	1275	830	0,5	1 294	510	0,4	745
Pentachlorobiphényles	330	2	601	470	1	733	210	0,8	307
Hexachlorobiphényles	270	1	492	320	0,3	499	150	0,4	219
Heptachlorobiphényles	90	1	164	80	0,5	125	40	0,4	58
Octachlorobiphényles	34	1	62	8,1	0,4	13	9,6	0,4	14
Nonachlorobiphényles	ND	1	0	6	0,5	9	2,8	0,4	4
Décachlorobiphényles	2,7	1	5	ND	0,5	0	ND	0,3	0
Total	**2 077**		**3 783**	**2 714**		**4 231**	**1 542**		**2 254**
Nombre de congénères	49			54			58		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

Une case vide indique que le groupe homologue n'a pas été analysé

CHÂTEAUGUAY - ÉTÉ 99

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
Congénères	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	15	0,1	569	10	0,07	339	14	0,1	487
IUPAC # 126	ND	0,2	0	NDR	0,2	0	NDR	0,2	0
IUPAC # 169	0,14	0,04	5	ND	0,09	0	ND	0,2	0
Trichlorobiphényles									
IUPAC # 18	180	6	6 825	120	4	4 063	150	4	5 213
IUPAC # 17	70	5	2 654	47	3	1 591	56	3	1 946
IUPAC # 31 + 28	400	5	15 166	290	3	9 818	300	3	10 425
IUPAC # 33 [1]	160	4	6 066	110	3	3 724	120	3	4 170
Tétrachlorobiphényles									
IUPAC # 52	220	0,5	8 341	150	0,3	5 078	190	0,3	6 603
IUPAC # 49 [1]	120	0,7	4 550	82	0,4	2 776	98	0,4	3 406
IUPAC # 44 [1]	130	0,6	4 929	80	0,4	2 708	120	0,4	4 170
IUPAC # 74	42	5	1 592	24	3	813	44	3	1 529
IUPAC # 70 [1]	130	4	4 929	78	2	2 641	110	3	3 823
Pentachlorobiphényles									
IUPAC # 95	160	2	6 066	100	2	3 386	140	2	4 865
IUPAC # 101	290	3	10 995	200	2	6 771	270	2	9 383
IUPAC # 99	100	3	3 792	71	2	2 404	92	2	3 197
IUPAC # 87	110	3	4 171	84	2	2 844	120	2	4 170
IUPAC # 110	150	2	5 687	110	1	3 724	150	1	5 213
IUPAC # 82	24	3	910	20	2	677	22	2	765
IUPAC # 118	120	2	4 550	86	1	2 912	120	1	4 170
IUPAC # 105	56	2	2 123	41	1	1 388	59	1	2 050
Hexachlorobiphényles									
IUPAC # 151	51	0,3	1 934	33	0,5	1 117	44	0,3	1 529
IUPAC # 149	170	0,3	6 446	110	0,5	3 724	150	0,3	5 213
IUPAC # 153 + 132	170	0,3	6 446	130	0,5	4 401	197	0,3	6 846
IUPAC # 138 + 158 [1]	183	0,3	6 938	107,6	0,5	3 643	173	0,3	6 012
IUPAC # 128	30	0,3	1 137	19	0,5	643	30	0,3	1 043
IUPAC # 156	21	1	796	12	0,8	406	19	2	660
Heptachlorobiphényles									
IUPAC # 187 [1]	46	0,2	1 744	31	0,5	1 050	44	0,2	1 529
IUPAC # 183	18	0,2	682	9,1	0,4	308	19	0,2	660
IUPAC # 177	20	0,9	758	14	2	474	20	1	695
IUPAC # 171	10	0,9	379	6,2	1	210	9,6	1	334
IUPAC # 180	67	0,8	2 540	46	1	1 557	69	1	2 398
IUPAC # 191 [1]	ND	0,7	0	ND	1	0	ND	0,9	0
IUPAC # 170 [1]	33	0,9	1 251	21	1	711	28	1	973
Octachlorobiphényles									
IUPAC # 199	17	0,5	645	10	0,8	339	18	0,6	626
IUPAC # 195	4,9	0,7	186	2,9	0,8	98	4,5	0,9	156
IUPAC # 194	11	0,7	417	8,2	0,9	278	10	0,9	348
IUPAC # 205	DNQ	0,6	0	ND	0,7	0	DNQ	0,7	0
Nonachlorobiphényles									
IUPAC # 208	3,2	0,4	121	1,3	0,4	44	NDR	0,4	0
IUPAC # 206	10	0,6	379	5,4	0,6	183	6,3	0,6	219
Décachlorobiphényles									
IUPAC # 209	10	0,3	379	7,4	0,4	251	6,5	0,3	226
Total (Σ 43 congénères)	3 352		127 100	2 277		77 091	3 023		105 046

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

CHÂTEAUGUAY - ÉTÉ 99

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	1100	4	41 707	690	2	23 360	800	2	27 800
Tétrachlorobiphényles	1200	0,5	45 498	760	0,3	25 730	1100	0,3	38 225
Pentachlorobiphényles	1200	2	45 498	810	1	27 423	1100	1	38 225
Hexachlorobiphényles	770	0,2	29 195	500	0,3	16 928	760	0,2	26 410
Heptachlorobiphényles	270	0,2	10 237	170	0,4	5 755	260	0,2	9 035
Octachlorobiphényles	37	0,5	1 403	67	0,7	2 268	26,5405	0,6	922
Nonachlorobiphényles	13	0,4	493	6,7	0,4	227	6,3	0,4	219
Décachlorobiphényles	10	0,3	379	7,4	0,4	251	6,5	0,3	226
Total	**4 600**		**174 409**	**3 011**		**101 941**	**4 059**		**141 062**
Nombre de congénères	73			68			73		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

CUM - ÉTÉ 98

Congénères de BPC : concentrations mesurées et charges

BPC Congénères	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	10	0,02	22 730	9,6	0,04	24 778	7,7	0,03	16 894
IUPAC # 126	DNQ	0,7	0	DNQ	0,5	0	DNQ	0,5	0
IUPAC # 169	0,22	0,02	500	ND	0,06	0	ND	0,05	0
Trichlorobiphényles									
IUPAC # 18	110	2	250 030	110	3	283 910	130	2	285 220
IUPAC # 17	39	2	88 647	40	2	103 240	52	2	114 088
IUPAC # 31 + 28	230	2	522 790	240	2	619 440	270	2	592 380
IUPAC # 33 [1]	100	2	227 300	110	2	283 910	120	2	263 280
Tétrachlorobiphényles									
IUPAC # 52	190	0,4	431 870	200	0,3	516 200	200	0,3	438 800
IUPAC # 49 [1]	74	0,4	168 202	71	0,3	183 251	74	0,4	162 356
IUPAC # 44 [1]	130	0,4	295 490	130	0,4	335 530	120	0,4	263 280
IUPAC # 74	64	2	145 472	86	5	221 966	81	3	177 714
IUPAC # 70 [1]	210	2	477 330	230	5	593 630	210	3	460 740
Pentachlorobiphényles									
IUPAC # 95	270	3	613 710	280	5	722 680	240	3	526 560
IUPAC # 101	380	3	863 740	410	4	1 058 210	340	3	745 960
IUPAC # 99	110	3	250 030	120	4	309 720	110	3	241 340
IUPAC # 87	150	3	340 950	150	5	387 150	140	3	307 160
IUPAC # 110	350	2	795 550	370	4	954 970	300	3	658 200
IUPAC # 82	34	3	77 282	38	5	98 078	26	3	57 044
IUPAC # 118	260	2	590 980	270	4	696 870	220	2	482 680
IUPAC # 105	89	2	202 297	96	3	247 776	80	2	175 520
Hexachlorobiphényles									
IUPAC # 151	84	0,8	190 932	87	0,9	224 547	70	0,8	153 580
IUPAC # 149	280	0,8	636 440	280	0,9	722 680	210	0,8	460 740
IUPAC # 153 + 132	400	0,9	909 200	430	0,9	1 109 830	336	0,9	737 184
IUPAC # 138 + 158 [1]	350	0,9	795 550	386	0,9	996 266	331	0,8	726 214
IUPAC # 128	57	0,9	129 561	61	0,9	157 441	43	0,9	94 342
IUPAC # 156	37	2	84 101	41	3	105 821	34	2	74 596
Heptachlorobiphényles									
IUPAC # 187 [1]	100	0,5	227 300	94	0,7	242 614	79	0,5	173 326
IUPAC # 183	NDR	0,5	0	50	0,7	129 050	35	0,5	76 790
IUPAC # 177	42	3	95 466	48	3	123 888	32	2	70 208
IUPAC # 171	22	3	50 006	23	3	59 363	18	2	39 492
IUPAC # 180	150	3	340 950	160	2	412 960	110	1	241 340
IUPAC # 191 [1]	DNQ	2	0	DNQ	2	0	3	1	6 582
IUPAC # 170 [1]	80	3	181 840	86	3	221 966	65	2	142 610
Octachlorobiphényles									
IUPAC # 199	ND	1	0	ND	1	0	ND	1	0
IUPAC # 195	17	2	38 641	NDR	2	0	12	2	26 328
IUPAC # 194	14	2	31 822	19	2	49 039	8,7	2	19 088
IUPAC # 205	DNQ	1	0	ND	1	0	ND	2	0
Nonachlorobiphényles									
IUPAC # 208	ND	1	0	5,5	1	14 196	6,7	1	14 700
IUPAC # 206	ND	2	0	20	2	51 620	16	2	35 104
Décachlorobiphényles									
IUPAC # 209	8,8	1	20 002	15	1	38 715	12	1	26 328
Total (Σ 43 congénères)	**4 442**		10 096 711	**4 766**		12 301 304	**4 142**		9 087 767

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

CUM - ÉTÉ 98

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	750	1	1 704 750	780	2	2 013 180	880	1	1 930 720
Tétrachlorobiphényles	1200	0,4	2 727 600	1300	0,3	3 355 300	1300	0,3	2 852 200
Pentachlorobiphényles	2000	2	4 546 000	2000	3	5 162 000	1700	2	3 729 800
Hexachlorobiphényles	1500	0,6	3 409 500	1600	0,6	4 129 600	1200	0,6	2 632 800
Heptachlorobiphényles	520	0,5	1 181 960	540	0,7	1 393 740	440	0,5	965 360
Octachlorobiphényles	31	1	70 463	62	1	160 022	72	1	157 968
Nonachlorobiphényles	ND	1	0	26	1	67 106	23	1	50 462
Décachlorobiphényles	8,8	1	20 002	15	1	38 715	12	1	26 328
Total	**6 010**		**13 660 275**	**6 323**		**16 319 663**	**5 627**		**12 345 638**
Nombre de congénères	**75**			**81**			**86**		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

CUO - ÉTÉ 99

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1999/07/05-06)			Jour 3 (1999/07/07-08)			Jour 5 (1999/07/09-10)		
Congénères	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	2,5	0,07	382	2,4	0,04	327	3,7	0,08	586
IUPAC # 126	ND	0,1	0	ND	0,1	0	ND	0,3	0
IUPAC # 169	ND	0,1	0	ND	0,1	0	ND	0,2	0
Trichlorobiphényles									
IUPAC # 18	130	4	19 879	130	4	17 697	140	7	22 171
IUPAC # 17	38	3	5 811	37	3	5 037	43	5	6 810
IUPAC # 31 + 28	190	3	29 054	173	3	23 551	198	5	31 356
IUPAC # 33 [1]	26	3	3 976	18	3	2 450	30	5	4 751
Tétrachlorobiphényles									
IUPAC # 52	88	0,3	13 457	85	0,6	11 571	100	0,3	15 837
IUPAC # 49 [1]	40	0,4	6 117	40	0,7	5 445	49	0,4	7 760
IUPAC # 44 [1]	48	0,3	7 340	45	0,7	6 126	52	0,4	8 235
IUPAC # 74	8,4	2	1 284	10	2	1 361	14	2	2 217
IUPAC # 70 [1]	26	2	3 976	30	2	4 084	41	1	6 493
Pentachlorobiphényles									
IUPAC # 95	29	0,8	4 435	29	1	3 948	45	1	7 126
IUPAC # 101	46	0,9	7 034	47	1	6 398	71	1	11 244
IUPAC # 99	16	0,9	2 447	17	1	2 314	23	1	3 642
IUPAC # 87	19	1	2 905	21	1	2 859	32	2	5 068
IUPAC # 110	27	0,6	4 129	27	0,7	3 676	42	0,9	6 651
IUPAC # 82	NDR	1	0	5,1	1	694	6,9	2	1 093
IUPAC # 118	18	0,6	2 752	21	0,7	2 859	32	0,9	5 068
IUPAC # 105	8,5	0,7	1 300	8,7	0,9	1 184	14	1	2 217
Hexachlorobiphényles									
IUPAC # 151	7,5	0,2	1 147	8,7	0,3	1 184	11	0,4	1 742
IUPAC # 149	30	0,2	4 587	29	0,3	3 948	45	0,4	7 126
IUPAC # 153 + 132	27,2	0,3	4 159	30,5	0,3	4 152	49	0,4	7 760
IUPAC # 138 + 158 [1]	22,2	0,2	3 395	25,7	0,3	3 499	41,7	0,4	6 604
IUPAC # 128	4,4	0,3	673	5,4	0,3	735	7,3	0,4	1 156
IUPAC # 156	ND	0,4	0	3,5	0,5	476	NDR	0,5	0
Heptachlorobiphényles									
IUPAC # 187 [1]	8,7	0,2	1 330	7,1	0,2	967	11	0,3	1 742
IUPAC # 183	4,6	0,2	703	4,1	0,2	558	4,9	0,3	776
IUPAC # 177	NDR	0,6	0	4,3	0,5	585	4,8	0,6	760
IUPAC # 171	2,3	0,6	352	ND	0,4	0	2,5	0,5	396
IUPAC # 180	12	0,5	1 835	12	0,4	1 634	15	0,5	2 375
IUPAC # 191 [1]	ND	0,4	0	ND	0,3	0	ND	0,4	0
IUPAC # 170 [1]	5,5	0,6	841	6,4	0,4	871	7,5	0,5	1 188
Octachlorobiphényles									
IUPAC # 199	5,1	0,4	780	2,6	0,2	354	4,4	0,5	697
IUPAC # 195	NDR	0,3	0	ND	0,5	0	ND	0,4	0
IUPAC # 194	1,7	0,3	260	DNQ	0,5	0	2,4	0,4	380
IUPAC # 205	ND	0,3	0	ND	0,4	0	DNQ	0,3	0
Nonachlorobiphényles									
IUPAC # 208	DNQ	0,4	0	DNQ	0,4	0	ND	0,2	0
IUPAC # 206	3	0,5	459	2,3	0,6	313	ND	0,3	0
Décachlorobiphényles									
IUPAC # 209	ND	0,4	0	1,1	0,2	150	2	0,2	317
Total (Σ 43 congénères)	**895**		**136 798**	**889**		**121 009**	**1 145**		**181 345**

ND : non détecté;   DNQ : détecté non quantifié;   NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	**Jour 1 (1999/07/05-06)**			**Jour 3 (1999/07/07-08)**			**Jour 5 (1999/07/09-10)**		
Groupes homologues	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dichlorobiphényles									
Trichorobiphényles	530	2	81 045	490	2	66 705	540	4	85 518
Tétrachlorobiphényles	360	0,3	55 049	360	0,6	49 008	480	0,3	76 016
Pentachlorobiphényles	180	0,6	27 525	200	0,7	27 227	310	0,9	49 093
Hexachlorobiphényles	110	0,1	16 821	110	0,2	14 975	180	0,2	28 506
Heptachlorobiphényles	48	0,2	7 340	42	0,2	5 718	55	0,3	8 710
Octachlorobiphényles	9,6	0,3	1 468	2,6	0,2	354	13	0,3	2 059
Nonachlorobiphényles	3	0,4	459	2,3	0,4	313	ND	0,2	0
Décachlorobiphényles	ND	0,4	0	1,1	0,2	150	2	0,2	317
Total	**1 241**		**189 706**	**1 208**		**164 449**	**1 580**		**250 218**
Nombre de congénères	**56**			**58**			60		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

CUQ (station Est) - ÉTÉ 99

Congénères de BPC : concentrations mesurées et charges

BPC Congénères	Jour 1 (1999/07/05-06)			Jour 3 (1999/07/07-08)			Jour 5 (1999/07/09-10)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	27	3	4825	22	2	5 067	30	2	5 441
IUPAC # 126	ND	0,4	0	2	0,5	461	ND	0,7	0
IUPAC # 169	ND	0,2	0	ND	0,6	0	ND	0,6	0
Trichlorobiphényles									
IUPAC # 18	170	10	30380	170	10	39 152	200	10	36 274
IUPAC # 17	70	10	12509	67	9	15 431	91	10	16 505
IUPAC # 31 + 28	480	10-7	85778	350	7 - 6	80 607	560	8 - 6	101 568
IUPAC # 33 [1]	210	9	37528	150	7	34 546	220	8	39 902
Tétrachlorobiphényles									
IUPAC # 52	380	1	67908	240	0,8	55 274	400	0,6	72 549
IUPAC # 49 [1]	220	2	39315	140	1	32 243	240	0,8	43 529
IUPAC # 44 [1]	270	1	48250	160	1	36 849	270	0,8	48 970
IUPAC # 74	130	8	23232	110	10	25 334	160	20	29 020
IUPAC # 70 [1]	350	7	62547	320	9	73 698	440	20	79 804
Pentachlorobiphényles									
IUPAC # 95	410	9	73269	380	9	87 517	580	40	105 196
IUPAC # 101	760	9	135816	610	9	140 487	850	40	154 166
IUPAC # 99	270	10	48250	260	10	59 880	320	50	58 039
IUPAC # 87	330	10	58973	210	10	48 364	300	50	54 412
IUPAC # 110	430	6	76843	300	6	69 092	420	30	76 176
IUPAC # 82	67	10	11973	45	10	10 364	ND	50	0
IUPAC # 118	290	6	51824	220	6	50 668	280	20	50 784
IUPAC # 105	140	7	25019	88	7	20 267	120	30	21 765
Hexachlorobiphényles									
IUPAC # 151	120	3	21445	89	2	20 497	140	2	25 392
IUPAC # 149	360	3	64334	280	2	64 486	400	2	72 549
IUPAC # 153 + 132	510	2-3	91140	330	2	76 001	480	2	87 059
IUPAC # 138 + 158 [1]	420	3-1	75056	250	2 - 1	57 577	365	2 - 1	66 201
IUPAC # 128	70	3	12509	44	2	10 134	60	2	10 882
IUPAC # 156	36	4	6433	NDR	7	0	NDR	6	0
Heptachlorobiphényles									
IUPAC # 187 [1]	110	2	19658	76	2	17 503	88	3	15 961
IUPAC # 183	42	2	7506	29	2	6 679	52	3	9 431
IUPAC # 177	58	8	10365	44	8	10 134	40	8	7 255
IUPAC # 171	30	8	5361	ND	8	0	24	8	4 353
IUPAC # 180	210	7	37528	150	7	34 546	190	7	34 461
IUPAC # 191 [1]	ND	6	0	ND	6	0	ND	6	0
IUPAC # 170 [1]	87	8	15547	57	8	13 127	71	8	12 877
Octachlorobiphényles									
IUPAC # 199	44	3	7863	24	2	5 527	38	2	6 892
IUPAC # 195	15	2	2681	DNQ	3	0	ND	4	0
IUPAC # 194	31	2	5540	34	3	7 830	31	4	5 623
IUPAC # 205	DNQ	2	0	ND	2	0	ND	3	0
Nonachlorobiphényles									
IUPAC # 208	6,3	1	1126	DNQ	2	0	7,9	2	1 433
IUPAC # 206	NDR	1	0	24	2	5 527	NDR	3	0
Décachlorobiphényles									
IUPAC # 209	19	1	3395	15	2	3 455	NDR	2	0
Total (Σ 43 congénères)	7 172		1 281 726	5 290		1 218 324	7 468		1 354 468

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

CUQ (station Est) - ÉTÉ 99

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	**Jour 1 (1999/07/05-06)**			**Jour 3 (1999/07/07-08)**			**Jour 5 (1999/07/09-10)**		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dichlorobiphényles									
Trichorobiphényles	1300	7	232 317	960	6	221 095	1500	6	272 058
Tétrachlorobiphényles	2600	1	464 633	1900	0,8	437 583	2700	0,6	489 704
Pentachlorobiphényles	3100	6	553 986	2400	6	552 737	3000	20	544 116
Hexachlorobiphényles	1800	1	321 669	1000	1	230 307	1800	1	326 470
Heptachlorobiphényles	720	2	128 668	440	2	101 335	620	3	112 451
Octachlorobiphényles	110	2	19 658	58	2	13 358	69	2	12 515
Nonachlorobiphényles	6,3	1	1 126	24	2	5 527	7,9	2	1 433
Décachlorobiphényles	19	1	3 395	15	2	3 455	NDR	2	0
Total	**9 655**		**1 725 450**	**6 797**		**1 565 397**	**9 697**		**1 758 746**
Nombre de congénères	68			55			59		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

COOKSHIRE - ÉTÉ 99

Congénères de BPC : concentrations mesurées et charges [2]

BPC	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
Congénères	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	25	2	49	30	2	58	39	4	76
IUPAC # 126	2,1	0,3	4	NDR	0,6	0	NDR	0,7	0
IUPAC # 169	ND	0,2	0	ND	0,2	0	ND	0,5	0
Trichlorobiphényles									
IUPAC # 18									
IUPAC # 17									
IUPAC # 31 + 28									
IUPAC # 33 [1]									
Tétrachlorobiphényles									
IUPAC # 52									
IUPAC # 49 [1]									
IUPAC # 44 [1]									
IUPAC # 74									
IUPAC # 70 [1]									
Pentachlorobiphényles									
IUPAC # 95									
IUPAC # 101									
IUPAC # 99									
IUPAC # 87									
IUPAC # 110									
IUPAC # 82									
IUPAC # 118									
IUPAC # 105									
Hexachlorobiphényles									
IUPAC # 151									
IUPAC # 149									
IUPAC # 153 + 132									
IUPAC # 138 + 158 [1]									
IUPAC # 128									
IUPAC # 156									
Heptachlorobiphényles									
IUPAC # 187 [1]									
IUPAC # 183									
IUPAC # 177									
IUPAC # 171									
IUPAC # 180									
IUPAC # 191 [1]									
IUPAC # 170 [1]									
Octachlorobiphényles									
IUPAC # 199									
IUPAC # 195									
IUPAC # 194									
IUPAC # 205									
Nonachlorobiphényles									
IUPAC # 208									
IUPAC # 206									
Décachlorobiphényles									
IUPAC # 209									
Total (Σ 43 congénères)	27		54	30		58	39		76

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Concentration maximale possible car ce congenère peut coéluer avec d'autres.

[2] : Les échantillons de Cookshire n'ont pu être analysés car ils étaient trop chargés en matière organique, ce qui faisait interférence et rendait impossible le dosage

COOKSHIRE - ÉTÉ 99

BPC totaux (groupes homologues) : concentrations mesurées et charges [1]

BPC Groupes homologues	Jour 1 (1999/07/12-13) [2]			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	710	10	1 404			0			0
Tétrachlorobiphényles	700	2	1 385			0			0
Pentachlorobiphényles	640	4	1 266			0			0
Hexachlorobiphényles	890	1	1 760			0			0
Heptachlorobiphényles	780	2	1 543			0			0
Octachlorobiphényles	12	2	24			0			0
Nonachlorobiphényles	ND	1	0			0			0
Décachlorobiphényles	ND	2	0			0			0
Total	**3 732**		**7 382**						
Nombre de congénères	41								

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

[1] : Les échantillons de Cookshire n'ont pu être analysés car ils étaient trop chargés en matière organique, ce qui faisait interférence et rendait impossible le dosage.

[2] : Les résultats du jour 1 sont donnés à titre indicatif car ils représentent les concentrations de la fraction dissoute seulement puisque le dosage de la fraction combinée était impossible (voir note 2 ci-dessus).

FARNHAM - ÉTÉ 99

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
Congénères	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	7,3	1	108	7,6	2	115	15	3	179
IUPAC # 126	ND	0,3	0	1,3	0,2	20	NDR	0,4	0
IUPAC # 169	ND	0,4	0	ND	0,3	0	ND	0,4	0
Trichlorobiphényles									
IUPAC # 18	130	10	1916	120	20	1 810	240	10	2 866
IUPAC # 17	51	9	752	56	10	845	100	10	1 194
IUPAC # 31 + 28	195	9-6	2874	196	10 - 9	2 956	510	8 - 7	6 089
IUPAC # 33 [1]	59	8	869	72	10	1 086	190	9	2 269
Tétrachlorobiphényles									
IUPAC # 52	120	1	1768	120	0,8	1 810	320	0,5	3 821
IUPAC # 49 [1]	61	1	899	68	1	1 026	200	0,6	2 388
IUPAC # 44 [1]	69	1	1017	76	0,9	1 146	180	0,6	2 149
IUPAC # 74	19	4	280	19	4	287	56	8	669
IUPAC # 70 [1]	45	3	663	54	3	814	160	7	1 910
Pentachlorobiphényles									
IUPAC # 95	74	4	1091	96	6	1 448	300	20	3 582
IUPAC # 101	140	4	2063	180	6	2 715	510	10	6 089
IUPAC # 99	48	5	707	62	7	935	170	20	2 030
IUPAC # 87	75	5	1105	83	8	1 252	200	20	2 388
IUPAC # 110	97	3	1429	110	4	1 659	290	9	3 463
IUPAC # 82	15	5	221	DNQ	7	0	DNQ	20	0
IUPAC # 118	78	3	1149	82	4	1 237	210	9	2 507
IUPAC # 105	41	3	604	39	4	588	88	10	1 051
Hexachlorobiphényles									
IUPAC # 151	25	25	368	30	0,8	452	77	0,9	919
IUPAC # 149	90	90	1326	100	0,7	1 508	280	0,9	3 343
IUPAC # 153 + 132	144	94	2122	139	0,6 - 0,8	2 096	340	0,7 - 1	4 060
IUPAC # 138 + 158 [1]	142	50	2093	133	0,7 - 0,4	2 006	304	0,8 - 0,5	3 630
IUPAC # 128	32	130	472	15	0,8	226	51	0,9	609
IUPAC # 156	13	12	192	17	2	256	36	4	430
Heptachlorobiphényles									
IUPAC # 187 [1]	34	1	501	NDR	0,6	0	NDR	0,8	0
IUPAC # 183	12	1	177	NDR	0,6	0	NDR	0,8	0
IUPAC # 177	ND	5	0	ND	5	0	NDR	3	0
IUPAC # 171	DNQ	5	0	DNQ	4	0	19	3	227
IUPAC # 180	48	4	707	50	4	754	120	3	1 433
IUPAC # 191 [1]	ND	4	0	ND	3	0	ND	2	0
IUPAC # 170 [1]	22	5	324	NDR	4	0	47	3	561
Octachlorobiphényles									
IUPAC # 199	44	1	648	22	2	332	39	0,7	466
IUPAC # 195	3	1	44	ND	2	0	ND	2	0
IUPAC # 194	18	1	265	18	2	271	41	2	490
IUPAC # 205	ND	1	0	ND	1	0	ND	2	0
Nonachlorobiphényles									
IUPAC # 208	15	1	221	16	2	241	35	3	418
IUPAC # 206	57	1	840	69	3	1 041	170	4	2 030
Décachlorobiphényles									
IUPAC # 209	11	1	162	NDR	2	0	41	1	490
Total (Σ 43 congénères)	2 034		29 979	2 051		30 930	5 339		63 748

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

FARNHAM - ÉTÉ 99

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	670	6	9 874	540	9	8 144	1400	7	16 716
Tétrachlorobiphényles	630	1	9 284	600	0,8	9 049	1800	0,5	21 492
Pentachlorobiphényles	630	3	9 284	680	4	10 255	2000	9	23 880
Hexachlorobiphényles	490	1	7 221	510	0,4	7 691	1200	0,5	14 328
Heptachlorobiphényles	160	1	2 358	67	0,6	1 010	220	0,8	2 627
Octachlorobiphényles	94	1	1 385	40	1	603	100	0,7	1 194
Nonachlorobiphényles	79	1	1 164	85	2	1 282	210	3	2 507
Décachlorobiphényles	11	1	162	NDR	2	0	41	1	490
Total	**2 764**		**40 733**	**2 522**		**38 034**	**6 971**		**83 234**
Nombre de congénères	55			43			61		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

JONQUIÈRE - ÉTÉ 98

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1998/09/14-15)			Jour 3 (1998/09/16-17)			Jour 5 (1998/09/18-19)		
Congénères	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Planaires									
IUPAC # 77	1,2	0,06	45	1,3	0,02	60	1,2	0,06	57
IUPAC # 126	ND	0,3	0	ND	0,4	0	ND	0,4	0
IUPAC # 169	ND	0,04	0	NDR	0,03	0	ND	0,05	0
Trichlorobiphényles									
IUPAC # 18	42	3	1 592	48	3	2 220	38	3	1 807
IUPAC # 17	19	2	720	17	2	786	14	2	666
IUPAC # 31 + 28	31	2	1 175	56	2	2 590	29	2	1 379
IUPAC # 33 [1]	ND	2	0	8,1	2	375	ND	2	0
Tétrachlorobiphényles									
IUPAC # 52	51	0,4	1 933	54	0,4	2 498	41	0,3	1 949
IUPAC # 49 [1]	28	0,4	1 061	30	0,4	1 388	24	0,3	1 141
IUPAC # 44 [1]	31	0,5	1 175	35	0,4	1 619	34	0,4	1 616
IUPAC # 74	17	0,9	644	20	0,9	925	16	0,5	761
IUPAC # 70 [1]	24	0,9	910	33	0,9	1 526	17	0,5	808
Pentachlorobiphényles									
IUPAC # 95	53	1	2 009	51	2	2 359	40	2	1 902
IUPAC # 101	42	1	1 592	72	2	3 330	47	2	2 235
IUPAC # 99	26	1	986	25	2	1 156	17	2	808
IUPAC # 87	33	1	1 251	36	2	1 665	29	2	1 379
IUPAC # 110	81	1	3 070	75	2	3 469	61	2	2 900
IUPAC # 82	9,7	1	368	9,2	2	426	NDR	2	0
IUPAC # 118	66	1	2 502	65	1	3 007	46	2	2 187
IUPAC # 105	24	0,9	910	22	1	1 018	16	2	761
Hexachlorobiphényles									
IUPAC # 151	12	0,5	455	18	0,6	833	8,2	0,7	390
IUPAC # 149	35	0,5	1 327	45	0,6	2 082	27	0,7	1 284
IUPAC # 153 + 132	63	0,6	2 388	73	0,6	3 377	43	0,7	2 044
IUPAC # 138 + 158 [1]	75	0,5	2 843	87,9	0,6	4 066	46	0,7	2 187
IUPAC # 128	15	0,6	569	9,3	0,6	430	7,4	0,7	352
IUPAC # 156	NDR	0,8	0	6,5	0,5	301	NDR	0,8	0
Heptachlorobiphényles									
IUPAC # 187 [1]	12	0,4	455	26	0,4	1 203	9,2	0,3	437
IUPAC # 183	6,6	0,4	250	NDR	0,4	0	3,7	0,3	176
IUPAC # 177	DNQ	2	0	NDR	1	0	4,7	1	223
IUPAC # 171	ND	2	0	ND	1	0	ND	1	0
IUPAC # 180	ND	1	0	ND	0,9	0	ND	0,8	0
IUPAC # 191 [1]	ND	1	0	ND	0,8	0	ND	0,7	0
IUPAC # 170 [1]	9,5	2	360	16	1	740	ND	0,9	0
Octachlorobiphényles									
IUPAC # 199	NDR	1	0	7,1	0,6	328	5,5	1	261
IUPAC # 195	ND	1	0	ND	0,8	0	ND	0,8	0
IUPAC # 194	4,8	1	182	7,6	0,8	352	DNQ	0,7	0
IUPAC # 205	ND	1	0	ND	0,6	0	ND	0,6	0
Nonachlorobiphényles									
IUPAC # 208	ND	0,4	0	ND	0,3	0	ND	0,5	0
IUPAC # 206	3,1	0,5	118	2,9	0,4	134	ND	0,6	0
Décachlorobiphényles									
IUPAC # 209	NDR	0,2	0	NDR	0,4	0	NDR	0,3	0
Total (Σ 43 congénères)	**815**		**30 890**	**957**		**44 262**	**625**		**29 710**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

JONQUIÈRE - ÉTÉ 98

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	Jour 1 (1998/09/14-15)			Jour 3 (1998/09/16-17)			Jour 5 (1998/09/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	190	2	7 202	260	2	12 027	160	2	7 607
Tétrachlorobiphényles	290	0,4	10 993	310	0,4	14 339	260	0,3	12 361
Pentachlorobiphényles	480	0,9	18 195	380	1	17 577	260	2	12 361
Hexachlorobiphényles	230	0,4	8 718	260	0,4	12 027	160	0,5	7 607
Heptachlorobiphényles	37	0,4	1 403	52	0,4	2 405	26	0,3	1 236
Octachlorobiphényles	4,8	1	182	18	0,6	833	10	0,6	475
Nonachlorobiphényles	3,1	0,4	118	2,9	0,3	134	ND	0,5	0
Décachlorobiphényles	NDR	0,2	0	NDR	0,4	0	NDR	0,3	0
Total	**1 235**		**46 810**	**1 283**		**59 342**	**876**		**41 648**
Nombre de congénères	50			49			44		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

LA PRAIRIE - ÉTÉ 99

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
Congénères	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Planaires									
IUPAC # 77	8,6	0,1	417	3,9	0,1	172	4,2	0,09	192
IUPAC # 126	ND	0,2	0	ND	0,2	0	ND	0,2	0
IUPAC # 169	ND	0,08	0	ND	0,1	0	ND	0,03	0
Trichlorobiphényles									
IUPAC # 18	300	6	14 542	180	20	7958	230	6	10 509
IUPAC # 17	97	4	4 702	60	10	2653	80	5	3 655
IUPAC # 31 + 28	360	5	17 451	340	10-8	15031	216	4 - 3	9 869
IUPAC # 33 [1]	68	4	3 296	81	10	3581	32	4	1 462
Tétrachlorobiphényles									
IUPAC # 52	150	0,5	7 271	120	1	5305	95	1	4 341
IUPAC # 49 [1]	100	0,7	4 847	86	2	3802	67	1	3 061
IUPAC # 44 [1]	100	0,6	4 847	75	2	3316	69	1	3 153
IUPAC # 74	36	2	1 745	20	5	884	20	2	914
IUPAC # 70 [1]	80	2	3 878	46	4	2034	32	2	1 462
Pentachlorobiphényles									
IUPAC # 95	73	1	3 539	47	3	2078	40	3	1 828
IUPAC # 101	130	1	6 302	93	3	4111	60	3	2 741
IUPAC # 99	49	1	2 375	38	4	1680	30	3	1 371
IUPAC # 87	58	2	2 811	39	4	1724	36	4	1 645
IUPAC # 110	76	0,8	3 684	51	2	2255	41	2	1 873
IUPAC # 82	13	2	630	ND	4	0	ND	4	0
IUPAC # 118	61	0,8	2 957	44	2	1945	32	2	1 462
IUPAC # 105	30	1	1 454	23	3	1017	18	3	822
Hexachlorobiphényles									
IUPAC # 151	25	1	1 212	16	2	707	10	2	457
IUPAC # 149	84	0,9	4 072	49	2	2166	NDR	2	0
IUPAC # 153 + 132	118	1	5 720	80	1-2	3537	46	2	2 102
IUPAC # 138 + 158 [1]	97,5	0,9	4 726	65	2-1	2874	47	2 - 1	2 147
IUPAC # 128	19	1	921	14	2	619	NDR	2	0
IUPAC # 156	9,7	2	470	7	1	309	8	0,8	366
Heptachlorobiphényles									
IUPAC # 187 [1]	30	0,3	1 454	17	1	752	NDR	2	0
IUPAC # 183	12	0,2	582	9	1	398	8	2	366
IUPAC # 177	14	2	679	DNQ	4	0	ND	4	0
IUPAC # 171	6,9	2	334	ND	4	0	ND	4	0
IUPAC # 180	37	1	1 794	34	4	1503	19	3	868
IUPAC # 191 [1]	ND	1	0	ND	3	0	ND	3	0
IUPAC # 170 [1]	17	2	824	13	4	575	DNQ	4	0
Octachlorobiphényles									
IUPAC # 199	12	0,8	582	11	1	486	ND	3	0
IUPAC # 195	3,9	0,9	189	ND	1	0	ND	2	0
IUPAC # 194	10	0,9	485	12	1	531	DNQ	2	0
IUPAC # 205	ND	0,8	0	ND	1	0	ND	2	0
Nonachlorobiphényles									
IUPAC # 208	NDR	0,5	0	ND	1	0	ND	1	0
IUPAC # 206	4,3	0,7	208	4	1	177	ND	2	0
Décachlorobiphényles									
IUPAC # 209	NDR	0,3	0	ND	1	0	ND	1	0
Total (Σ 43 congénères)	2 290		111 001	1 678		74 178	1 240		56 665

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres

LA PRAIRIE - ÉTÉ 99

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	**Jour 1 (1999/06/14-15)**			**Jour 3 (1999/06/16-17)**			**Jour 5 (1999/06/18-19)**		
Groupes homologues	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dichlorobiphényles									
Trichorobiphényles	1300	3	63 016	850	6	37 578	880	3	40 207
Tétrachlorobiphényles	910	0,5	44 111	660	1	29 178	360	1	16 448
Pentachlorobiphényles	540	0,8	26 176	340	2	15 031	280	2	12 793
Hexachlorobiphényles	440	0,5	21 329	270	1	11 936	120	0,8	5 483
Heptachlorobiphényles	170	0,2	8 241	93	1	4 111	27	2	1 234
Octachlorobiphényles	32	0,8	1 551	29	1	1 282	ND	2	0
Nonachlorobiphényles	6,1	0,5	296	4	1	177	ND	1	0
Décachlorobiphényles	NDR	0,3	0	ND	1	0	ND	1	0
Total	**3 398**		**164 719**	**2 246**		**99 293**	**1 667**		**76 165**
Nombre de congénères	73			51			36		

ND : non détecté;   DNQ : détecté non quantifié;   NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

LONGUEUIL - ÉTÉ 98

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
Congénères	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	12	0,02	2 964	12	0,04	3 360	3,9	0,05	978
IUPAC # 126	NDR	0,09	0	ND	0,4	0	ND	0,8	0
IUPAC # 169	ND	0,03	0	ND	0,05	0	ND	0,04	0
Trichlorobiphényles									
IUPAC # 18	120	3	29 640	75	4	21 000	100	2	25 067
IUPAC # 17	42	3	10 374	31	3	8 680	35	2	8 773
IUPAC # 31 + 28	280	3	69 160	107	3	29 960	178	2	44 619
IUPAC # 33 [1]	130	3	32 110	53	3	14 840	84	2	21 056
Tétrachlorobiphényles									
IUPAC # 52	280	0,4	69 160	92	0,3	25 760	280	1	70 187
IUPAC # 49 [1]	100	0,4	24 700	44	0,4	12 320	99	1	24 816
IUPAC # 44 [1]	150	0,4	37 050	59	0,4	16 520	140	1	35 093
IUPAC # 74	94	2	23 218	37	2	10 360	120	3	30 080
IUPAC # 70 [1]	280	2	69 160	65	2	18 200	330	3	82 720
Pentachlorobiphényles									
IUPAC # 95	450	2	111 150	100	3	28 000	430	6	107 787
IUPAC # 101	790	2	195 130	150	3	42 000	740	5	185 494
IUPAC # 99	230	2	56 810	NDR	3	0	270	5	67 680
IUPAC # 87	280	2	69 160	61	3	17 080	310	6	77 707
IUPAC # 110	640	2	158 080	140	2	39 200	720	5	180 480
IUPAC # 82	61	2	15 067	13	3	3 640	70	6	17 547
IUPAC # 118	540	2	133 380	110	2	30 800	670	5	167 947
IUPAC # 105	190	2	46 930	38	2	10 640	280	4	70 187
Hexachlorobiphényles									
IUPAC # 151	230	0,7	56 810	30	0,6	8 400	120	1	30 080
IUPAC # 149	780	0,7	192 660	92	0,6	25 760	460	1	115 307
IUPAC # 153 + 132	1070	0,7	264 290	149	0,7	41 720	760	1	190 507
IUPAC # 138 + 158 [1]	1183	0,7	292 201	151	0,7	42 280	918	1	230 112
IUPAC # 128	150	0,7	37 050	24	0,7	6 720	170	1	42 613
IUPAC # 156	93	3	22 971	19	2	5 320	95	2	23 813
Heptachlorobiphényles									
IUPAC # 187 [1]	330	0,7	81 510	32	0,4	8 960	160	1	40 107
IUPAC # 183	170	0,7	41 990	17	0,4	4 760	84	1	21 056
IUPAC # 177	140	6	34 580	14	1	3 920	74	2	18 549
IUPAC # 171	79	6	19 513	8,1	1	2 268	41	2	10 277
IUPAC # 180	600	5	148 200	19	1	5 320	310	2	77 707
IUPAC # 191 [1]	15	4	3 705	ND	1	0	8,3	1	2 081
IUPAC # 170 [1]	300	6	74 100	28	1	7 840	180	2	45 120
Octachlorobiphényles									
IUPAC # 199	120	1	29 640	16	1	4 480	65	2	16 293
IUPAC # 195	50	3	12 350	ND	2	0	30	2	7 520
IUPAC # 194	120	2	29 640	11	1	3 080	40	2	10 027
IUPAC # 205	7,2	2	1 778	ND	1	0	4	1	1 003
Nonachlorobiphényles									
IUPAC # 208	12	0,6	2 964	2,3	0,4	644	2,7	1	677
IUPAC # 206	43	0,8	10 621	7,5	0,6	2 100	17	1	4 261
Décachlorobiphényles									
IUPAC # 209	8	0,4	1 976	5,2	0,7	1 456	7	1	1 755
Total (Σ 43 congénères)	10 169		2 511 792	1 812		507 388	8 406		2 107 082

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

LONGUEUIL - ÉTÉ 98

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	810	2	200 070	440	2	123 200	630	2	157 920
Tétrachlorobiphényles	1500	0,4	370 500	560	0,3	156 800	1600	1	401 067
Pentachlorobiphényles	3600	2	889 200	640	2	179 200	4000	4	1 002 668
Hexachlorobiphényles	4200	0,5	1 037 400	530	0,5	148 400	3100	1	777 068
Heptachlorobiphényles	1900	0,7	469 300	120	0,4	33 600	990	1	248 160
Octachlorobiphényles	470	1	116 090	48	1	13 440	250	1	62 667
Nonachlorobiphényles	63	0,6	15 561	11	0,4	3 080	20	1	5 013
Décachlorobiphényles	8	0,4	1 976	5,2	0,7	1 456	7	1	1 755
Total	**12 551**		**3 100 097**	**2 354**		**659 176**	**10 597**		**2 656 318**
Nombre de congénères	**82**			**64**			**87**		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

SAINT-GÉDÉON - ÉTÉ 98

Congénères de BPC : concentrations mesurées et charges

BPC Congénères	Jour 1 (1998/09/15)			Jour 3 (1998/09/17)			Jour 5 (1998/09/19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (µg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	NDR	0,03	0	2,4	0,04	1	2,7	0,08	2
IUPAC # 126	ND	0,1	0	ND	0,3	0	0,96	0,3	1
IUPAC # 169	ND	0,05	0	ND	0,06	0	NDR	0,08	0
Trichlorobiphényles									
IUPAC # 18	45	5	22	37	4	18	34	5	22
IUPAC # 17	18	4	9	19	4	9	16	4	11
IUPAC # 31 + 28	137	4	66	102	4	49	97	4	64
IUPAC # 33 [1]	40	4	19	22	3	11	21	3	14
Tétrachlorobiphényles									
IUPAC # 52	48	0,6	23	38,5	0,7	18	35	0,6	23
IUPAC # 49 [1]	12	0,6	6	8,3	0,7	4	3	0,6	2
IUPAC # 44 [1]	41	0,7	20	33	0,8	16	26	0,7	17
IUPAC # 74	19	1	9	18	1	9	15	2	10
IUPAC # 70 [1]	49	0,9	23	47	1	22	40	1	26
Pentachlorobiphényles									
IUPAC # 95	48	2	23	52	3	25	37	2	24
IUPAC # 101	74	2	35	71	3	34	68	2	45
IUPAC # 99	25	2	12	22	3	11	23	2	15
IUPAC # 87	34	2	16	30	4	14	27	2	18
IUPAC # 110	72	2	34	60	3	29	61	2	40
IUPAC # 82	8,7	2	4	DNQ	3	0	NDR	2	0
IUPAC # 118	70	2	34	55	3	26	51	2	34
IUPAC # 105	27	2	13	18	2	9	17	2	11
Hexachlorobiphényles									
IUPAC # 151	16	1	8	9,7	1	5	9,4	0,9	6
IUPAC # 149	54	1	26	NDR	1	0	37	0,9	24
IUPAC # 153 - 132	81	1	39	54	1	26	53	1	35
IUPAC # 138 - 158 [1]	153	1	73	49	1	23	102	0,9	67
IUPAC # 128	18	1	9	8,4	1	4	10	1	7
IUPAC # 156	ND	1	0	NDR	0,7	0	ND	0,9	0
Heptachlorobiphényles									
IUPAC # 187 [1]	30	0,8	14	17	0,8	8	13	0,6	9
IUPAC # 183	15	0,8	7	6,4	0,8	3	5,6	0,6	4
IUPAC # 177	ND	3	0	ND	2	0	NDR	1	0
IUPAC # 171	DNQ	3	0	ND	2	0	NDR	1	0
IUPAC # 180	33	2	16	19	1	9	17	1	11
IUPAC # 191 [1]	ND	2	0	ND	1	0	ND	1	0
IUPAC # 170 [1]	15	3	7	NDR	1	0	9,5	1	6
Octachlorobiphényles									
IUPAC # 199	19	2	9	NDR	1	0	6,2	1	4
IUPAC # 195	ND	2	0	ND	1	0	ND	1	0
IUPAC # 194	9,4	2	4	3,6	1	2	DNQ	1	0
IUPAC # 205	ND	1	0	ND	0,9	0	ND	0,9	0
Nonachlorobiphényles									
IUPAC # 208	NDR	0,3	0	ND	0,7	0	ND	0,6	0
IUPAC # 206	NDR	0,5	0	DNQ	0,9	0	DNQ	0,8	0
Décachlorobiphényles									
IUPAC # 209	3,2	0,3	2	2,1	0,6	1	ND	0,4	0
Total (Σ 43 congénères)	1 214		581	804		385	837		552

ND : non détecté;   DNQ : détecté non quantifié;   NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres

SAINT-GÉDÉON - ÉTÉ 98

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC Groupes homologues	Jour 1 (1998/09/15)			Jour 3 (1998/09/17)			Jour 5 (1998/09/19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	280	3	134	270	3	129	210	3	138
Tétrachlorobiphényles	300	0,6	144	280	0,7	134	230	0,6	152
Pentachlorobiphényles	410	2	196	330	2	158	300	2	198
Hexachlorobiphényles	360	0,7	172	130	0,7	62	210	0,7	138
Heptachlorobiphényles	110	0,8	53	48	0,8	23	49	0,6	32
Octachlorobiphényles	47	1	22	6,9	0,9	3	15	0,9	10
Nonachlorobiphényles	2,2	0,3	1	ND	0,7	0	ND	0,6	0
Décachlorobiphényles	3,2	0,3	2	2,1	0,6	1	ND	0,4	0
Total	**1 512**		**724**	**1 067**		**511**	**1 014**		**668**
Nombre de congénères	53			45			42		

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

Une case vide indique que le groupe homologue n'a pas été analysé.

SAINT-JOSEPH-DE-BEAUCE - ÉTÉ 98

Congénères de BPC : concentrations mesurées et charges

BPC	Jour 1 (1998/09/21)			Jour 3 (1998/09/23)			Jour 5 (1998/09/25)		
Congénères	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Planaires									
IUPAC # 77	1,4	0,09	4	0,78	0,03	4	1,4	0,04	5
IUPAC # 126	ND	0,4	0	ND	0,4	0	ND	0,4	0
IUPAC # 169	ND	0,06	0	ND	0,03	0	ND	0,06	0
Trichlorobiphényles									
IUPAC # 18	55	4	155	53	3	256	67	4	259
IUPAC # 17	NDR	3	0	19	3	92	22	3	85
IUPAC # 31 + 28	69	3	195	64	3	309	88	3	340
IUPAC # 33 [1]	DNQ	3	0	ND	3	0	10	3	39
Tétrachlorobiphényles									
IUPAC # 52	70	0,4	198	68	0,5	328	94	0,4	363
IUPAC # 49 [1]	29	0,4	82	28	0,5	135	39	0,4	151
IUPAC # 44 [1]	40	0,5	113	40	0,5	193	53	0,4	205
IUPAC # 74	24	1	68	24	0,8	116	32	2	124
IUPAC # 70 [1]	49	1	138	37	0,8	178	59	2	228
Pentachlorobiphényles									
IUPAC # 95	65	0,9	183	66	1	318	91	1	352
IUPAC # 101	85	0,8	240	81	1	391	110	1	425
IUPAC # 99	34	0,8	96	29	1	140	39	1	151
IUPAC # 87	42	0,9	119	38	1	183	54	1	209
IUPAC # 110	89	0,8	251	82	1	395	110	0,9	425
IUPAC # 82	8,8	0,9	25	9,1	1	44	10	1	39
IUPAC # 118	64	0,7	181	62	1	299	80	0,9	309
IUPAC # 105	22	0,6	62	22	1	106	28	0,8	108
Hexachlorobiphényles									
IUPAC # 151	11	0,5	31	11	0,6	53	12	0,5	46
IUPAC # 149	30	0,5	85	31	0,6	149	42	0,5	162
IUPAC # 153 + 132	58	0,6	164	56	0,6	270	75	0,6	290
IUPAC # 138 + 158 [1]	73,7	0,5	208	57,2	0,6	276	87	0,5	336
IUPAC # 128	12	0,6	34	10	0,6	48	13	0,5	50
IUPAC # 156	3,6	0,8	10	NDR	0,9	0	7,5	0,5	29
Heptachlorobiphényles									
IUPAC # 187 [1]	12	0,5	34	14	0,6	68	14	0,4	54
IUPAC # 183	NDR	0,5	0	NDR	0,6	0	6,5	0,4	25
IUPAC # 177	ND	0,8	0	3,9	0,8	19	6,5	0,9	25
IUPAC # 171	ND	0,8	0	ND	0,8	0	3,7	0,9	14
IUPAC # 180	ND	0,7	0	ND	0,7	0	ND	0,8	0
IUPAC # 191 [1]	ND	0,6	0	ND	0,6	0	ND	0,7	0
IUPAC # 170 [1]	8,7	0,8	25	9,5	0,8	46	12	0,9	46
Octachlorobiphényles									
IUPAC # 199	ND	1	0	7,1	0,9	34	8,9	0,9	34
IUPAC # 195	ND	1	0	DNQ	1	0	3	0,8	12
IUPAC # 194	ND	0,9	0	DNQ	0,9	0	4,9	0,7	19
IUPAC # 205	ND	0,8	0	ND	0,7	0	ND	0,6	0
Nonachlorobiphényles									
IUPAC # 208	DNQ	0,6	0	NDR	0,4	0	DNQ	0,4	0
IUPAC # 206	ND	0,8	0	2,5	0,5	12	4,9	0,5	19
Décachlorobiphényles									
IUPAC # 209	2,6	0,3	7	NDR	0,4	0	3,4	0,4	13
Total (Σ 43 congénères)	959		2 707	925		4 461	1 292		4 995

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Concentration maximale possible car ce congénère peut coéluer avec d'autres.

SAINT-JOSEPH-DE-BEAUCE - ÉTÉ 98

BPC totaux (groupes homologues) : concentrations mesurées et charges

BPC	Jour 1 (1998/09/21)			Jour 3 (1998/09/23)			Jour 5 (1998/09/25)		
Groupes homologues	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dichlorobiphényles									
Trichorobiphényles	210	3	593	220	2	1 061	280	2	1 083
Tétrachlorobiphényles	370	0,4	1 045	330	0,5	1 591	490	0,4	1 895
Pentachlorobiphényles	460	0,6	1 299	420	1	2 025	570	0,8	2 204
Hexachlorobiphényles	220	0,4	621	180	0,4	868	260	0,4	1 005
Heptachlorobiphényles	21	0,5	59	27	0,6	130	47	0,4	182
Octachlorobiphényles	ND	0,8	0	7,1	0,7	34	20	0,6	77
Nonachlorobiphényles	ND	0,6	0	2,5	0,4	12	4,9	0,4	19
Décachlorobiphényles	2,6	0,3	7	NDR	0,4	0	3,4	0,4	13
Total	**1 284**		**3 624**	**1 187**		**5 722**	**1 675**		**6 478**
Nombre de congénères	46			41			59		

ND : non détecté. DNQ : détecté non quantifié. NDR : détecté mais ne satisfait pas le rapport isotopique.

Une case vide indique que le groupe homologue n'a pas été analysé.

APPENDIX 11

RESULTS OF ANALYSES OF TRACE-LEVEL PAHS

Winter sampling: pages 177 to 181
Summer sampling: pages 182 to 192

Explanatory note on the presentation of results in Appendix 11:

The analysis of organic substances at trace levels first requires separation of the dissolved and particulate phases from samples, followed by extraction and then purification of each phase.

During the 1996–97 sampling campaign, purified dissolved and particulate phases were analysed separately. The tabulated results for PAHs at plants sampled in 1996 and 1997 therefore present the analytical results for both phases, plus the mathematical value of the sum of these two results, with the aim of obtaining the total concentration of the sample.

During the 1998–99 sampling campaign, in a cost-saving move, the purified extracts of both phases were mixed and the total concentration was analysed from this combined extract. Consequently, the tabulated results of plants sampled in 1998 and 1999 present a single analytical result per sampling day.

CUQ (station Est) - HIVER 97

HAP : concentrations mesurées et charges

HAP	Jour 1 (1997/01/06-07)						Jour 3 (1997/01/08-09)						Jour 5 (1997/01/10-11)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)
HAP - groupe 1																		
Benzo(a)anthracène	1100	300	DNQ	1000	1100	177	990	20	DNQ	2000	990	150	DNQ	300	2700	700	2700	429
Chrysène	3100	300	8500	1000	11600	1 871	2700	30	6500	2000	9200	1 391	2400	200	7600	1000	10000	1 590
Benzo(b+j)fluoranthène	1100	20	3000	200	4100	661	910	40	3400	200	4310	652	760	20	870	100	1630	259
Benzo(k)fluoranthène	390	30	830	200	1220	197	300	40	810	200	1110	168	250	20	700	100	950	151
Benzo(a)pyrène	850	50	1700	300	2550	411	660	40	2000	300	2660	402	510	30	1700	200	2210	351
Indéno-1,2,3(c,d)pyrène	410	10	1100	50	1510	244	DNQ	20	970	40	970	147	220	20	900	40	1120	178
Dibenzo(a,h)anthracène	85	20	DNQ	100	85	14	DNQ	30	ND	80	0	0	DNQ	30	DNQ	70	0	0
Sous total - groupe 1	**7 035**		**15 130**		**22 165**	**3 575**	**5 560**		**13 680**		**19 240**	**2 910**	**4 140**		**14 470**		**18 610**	**2 959**
HAP - groupe 2 et autres																		
Acénaphtène	24000	2000	ND	40	24000	3 871	26000	4000	ND	300	26000	3 932	24000	1000	ND	200	24000	3 816
Acénaphthylène	DNQ	8000	DNQ	200	0	0	11000	2000	ND	400	11000	1 664	DNQ	7000	ND	400	0	0
Anthracène	DNQ	4000	DNQ	3000	0	0	DNQ	300	DNQ	3000	0	0	10000	3000	DNQ	2000	10000	1 590
Benzo(g,h,i)pérylène	850	7	2100	40	2950	476	880	10	2300	30	3180	481	550	10	2000	30	2550	405
Benzo(e)pyrène	1000	30	1800	100	2800	452	920	30	2500	200	3420	517	700	20	2100	100	2800	445
Fluoranthène	6500	9	8814	40	15314	2 470	5800	300	10000	50	15800	2 389	6100	30	7300	50	13400	2 130
Fluorène	41000	300	1510	80	42510	6 856	59000	10	1500	60	60500	9 150	58000	800	700	100	58700	9 333
Naphtalène	290000	5000	500	70	290500	46 850	270000	5000	300	40	270300	40 879	240000	9000	600	200	240600	38 253
Pérylène	150	40	DNQ	200	150	24	DNQ	40	DNQ	300	0	0	110	30	380	100	490	78
Phenanthrène	74000	2000	24700	2000	98700	15 918	76000	20	21000	2000	97000	14 670	66000	2000	dnq	2000	66000	10 493
Pyrène	16000	10	27000	50	43000	6 935	15000	20	24000	60	39000	5 898	16000	30	20000	60	36000	5 724
1-Méthylnaphtalène	270000	300	320	40	270320	43 596	250000	600	310	70	250310	37 855	230000	600	350	100	230350	36 623
2-Méthylnaphtalène	370000	300	510	40	370510	59 754	350000	600	DNQ	50	350000	52 932	280000	600	610	100	280610	44 614
1,3-Diméthylnaphtalène	450000	9000	1060	400	451060	72 744	480000	10000	1170	300	481170	72 769	500000	1000	DNQ	500	500000	79 495
HAP totaux	**1 550 535**		**83 444**		**1 633 979**	**263 518**	**1 550 160**		**76 760**		**1 626 920**	**246 046**	**1 435 600**		**48 510**		**1 484 110**	**235 957**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

FARNHAM - HIVER 97

HAP : concentrations mesurées et charges

HAP	Jour 1 (1997/02/10-11)						Jour 3 (1997/02/12-13)						Jour 5 (1997/02/14-15)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)
HAP - groupe 1																		
Benzo(a)anthracène	640	200	730	50	1370	18	1500	200	1100		2600	33	1900	300	1600	200	3500	46
Chrysène	2600	200	1600	60	4200	54	5800	300	2300		8100	103	6900	400	3000	200	9900	130
Benzo(b+j)fluoranthène	1500	30	1700	5	3200	41	4000	80	2200		6200	79	5800	60	2900	40	8700	114
Benzo(k)fluoranthène	550	40	680	4	1230	16	1400	90	780		2180	28	1100	50	1200	40	2300	30
Benzo(a)pyrène	870	60	1000	7	1870	24	1800	200	1500		3300	42	2500	100	2100	60	4600	60
Indéno-1,2,3(c,d)pyrène	470	60	790	10	1260	16	1200	200	1200		2400	31	1500	100	1400	30	2900	38
Dibenzo(a,h)anthracène	ND	100	130	20	130	2	ND	300	190		190	2	DNQ	300	370	60	370	5
Sous total - groupe 1	**6 630**		**6 630**		**13 260**	**171**	**15 700**		**9 270**		**24 970**	**318**	**19 700**		**12 570**		**32 270**	**423**
HAP - groupe 2 et autres																		
Acénaphtène	ND	600	DNQ	50	0	0	ND	700	DNQ		0	0	DNQ	400	ND	200	0	0
Acénaphthylène	ND	500	DNQ	50	0	0	ND	700	DNQ		0	0	ND	600	DNQ	90	0	0
Anthracène	ND	500	DNQ	100	0	0	ND	800	DNQ		0	0	ND	900	DNQ	300	0	0
Benzo(g,h,i)pérylène	1200	40	1200	8	2400	31	3500	100	1600		5100	65	4300	80	1700	20	6000	79
Benzo(e)pyrène	990	30	1100	6	2090	27	3400	80	1500		4900	62	3800	50	1900	40	5700	75
Fluoranthène	1000	30	2600	9	3600	46	2300	40	4000		6300	80	3600	40	4300	30	7900	103
Fluorène	1500	200	320	20	1820	24	2100	200	490		2590	33	2300	300	540	90	2840	37
Naphtalène	7400	900	600	70	8000	103	12000	1000	1200		13200	168	12000	700	1100	80	13100	172
Pérylène	230	50	330	6	560	7	680	100	460		1140	15	840	70	630	60	1470	19
Phénanthrène	2500	300	2800	80	5300	68	4200	600	4000		8200	105	3800	700	3900	300	7700	101
Pyrène	7500	30	4000	9	11500	149	15000	40	5300		20300	259	15000	30	6400	30	21400	280
1-Méthylnaphtalène	4100	80	250	60	4350	56	5900	100	510		6410	82	5400	90	560	100	5960	78
2-Méthylnaphtalène	5300	80	550	50	5850	76	9500	100	1150		10650	136	7200	90	1250	90	8450	111
1,3-Diméthylnaphtalène	6300	1000	590	70	6890	89	10000	2000	970		10970	140	7600	1000	1100	100	8700	114
HAP totaux	**44 650**		**20 970**		**65 620**	**847**	**84 280**		**30 450**		**114 730**	**1 463**	**85 540**		**35 950**		**121 490**	**1 591**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

LA PRAIRIE - HIVER 96

HAP : concentrations mesurées et charges

HAP	Jour 1 (1996/12/02-03)						Jour 3 (1996/12/04-05)						Jour 5 (1996/12/06-07)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)
HAP - groupe 1																		
Benzo(a)anthracène	120	30	670	10	790	40	130	20	500	20	630	31	120	30	700	30	820	37
Chrysène	400	30	1200	20	1600	81	440	20	1100	20	1540	75	430	30	1800	30	2230	101
Benzo(b+j)fluoranthène	140	6	1300	3	1440	72	150	3	1200	3	1350	66	210	6	1700	6	1910	87
Benzo(k)fluoranthène	39	6	490	2	529	27	51	3	460	2	511	25	71	6	690	5	761	35
Benzo(a)pyrène	64	10	860	4	924	47	76	6	800	4	876	43	120	10	1200	8	1320	60
Indéno-1,2,3(c,d)pyrène	45	5	650	4	695	35	DNQ	2	530	3	530	26	78	3	820	6	898	41
Dibenzo(a,h)anthracène	ND	10	140	8	140	7	50	5	140	7	190	9	18	4	210	10	228	10
Sous total - groupe 1	**808**		**5 310**		**6 118**	**308**	**897**		**4 730**		**5 627**	**276**	**1 047**		**7 120**		**8 167**	**370**
HAP - groupe 2 et autres																		
Acénaphtène	DNQ	400	DNQ	60	0	0	DNQ	500	DNQ	30	0	0	8000	600	DNQ	40	8000	363
Acénaphthylène	DNQ	200	160	50	160	8	DNQ	200	200	40	200	10	DNQ	500	200	40	200	9
Anthracène	ND	1000	150	40	150	8	ND	1000	DNQ	70	0	0	ND	2000	290	80	290	13
Benzo(g,h,i)pérylène	75	4	620	3	695	35	63	2	530	2	593	29	110	2	900	4	1010	46
Benzo(e)pyrène	110	7	920	3	1030	52	130	4	960	3	1090	53	220	6	1600	6	1820	83
Fluoranthène	2700	20	1900	5	4600	232	1500	20	1700	10	3200	157	2000	20	2500	10	4500	204
Fluorène	2000	100	360	10	2360	119	2500	100	240	10	2740	134	14000	200	420	20	14420	654
Naphtalène	14000	300	810	30	14810	745	1800	600	800	30	2600	127	53000	2000	1400	50	54400	2 467
Pérylène	DNQ	10	190	5	190	10	DNQ	6	180	5	180	9	32	10	220	7	252	11
Phénanthrène	3900	900	1400	30	5300	267	2200	700	1400	50	3600	176	5800	1000	2100	60	7900	358
Pyrène	3800	20	2700	6	6500	327	3700	20	2700	9	6400	314	3600	20	4600	10	8200	372
1-Méthylnaphtalène	4600	50	400	30	5000	252	4100	20	300	20	4400	216	35000	50	610	30	35610	1 615
2-Méthylnaphtalène	6500	40	500	20	7000	352	5700	20	390	20	6090	298	36000	40	660	30	36660	1 663
1,3-Diméthylnaphtalène	8800	2000	640	40	9440	475	6000	2000	500	40	6500	318	32000	2000	700	60	32700	1 483
HAP totaux	**47 293**		**16 060**		**63 353**	**3 189**	**28 590**		**14 630**		**43 220**	**2 117**	**190 809**		**23 320**		**214 129**	**9 712**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

LONGUEUIL - HIVER 96

HAP : concentrations mesurées et charges

HAP	Jour 1 (1996/12/09-10)						Jour 3 (1996/12/11-12)						Jour 5 (1996/12/13-14)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (mg/j)
HAP - groupe 1																		
Benzo(a)anthracène	ND	200	920	100	920	295	ND	100	1400	200	1400	414	DNQ	100	1400	200	1400	454
Chrysène	ND	200	2800	200	2800	899	DNQ	100	3000	300	3000	888	760	200	4800	200	5560	1 801
Benzo(b+j)fluoranthène	DNQ	40	1500	20	1500	482	120	10	1800	40	1920	568	230	10	2500	30	2730	885
Benzo(k)fluoranthène	ND	40	600	20	600	193	34	10	640	30	674	200	DNQ	10	1000	30	1000	324
Benzo(a)pyrène	ND	70	890	30	890	286	ND	20	1000	50	1000	296	100	20	1400	40	1500	486
Indéno-1,2,3(c,d)pyrène	ND	100	580	10	580	186	32	7	710	20	742	220	62	8	1000	20	1062	344
Dibenzo(a,h)anthracène	ND	200	130	30	130	42	ND	10	160	40	160	47	ND	20	240	40	240	78
Sous total - groupe 1	**0**		**7 420**		**7 420**	**2 382**	**186**		**8 710**		**8 896**	**2 633**	**1 152**		**12 340**		**13 492**	**4 371**
HAP - groupe 2 et autres																		
Acénaphtène	19000	2000	ND	400	19000	6 099	24000	4000	ND	600	24000	7 104	24000	4000	ND	200	24000	7 776
Acénaphthylène	4500	1000	ND	600	4500	1 445	DNQ	7000	DNQ	200	0	0	ND	9000	DNQ	100	0	0
Anthracène	ND	3000	DNQ	800	0	0	4400	800	DNQ	700	4400	1 302	5200	700	1200	0	6400	2 074
Benzo(g,h,i)pérylène	ND	60	730	10	730	234	45	5	1000	10	1045	309	80	6	1200	10	1280	415
Benzo(e)pyrène	ND	40	1100	20	1100	353	76	10	1400	40	1476	437	160	10	1900	30	2060	667
Fluoranthène	3800	100	6300	20	10100	3 242	3600	20	6200	30	9800	2 901	6300	20	9400	20	15700	5 087
Fluorène	53000	400	1500	70	54500	17 495	46000	400	2000	90	48000	14 208	45000	200	1100	60	46100	14 936
Naphtalène	270000	8000	1700	90	271700	87 216	370000	3000	2000	100	372000	110 112	280000	8000	1600	90	281600	91 238
Pérylène	ND	70	170	30	170	55	ND	20	230	50	230	68	DNQ	20	280	40	280	91
Phénanthrène	55000	2000	12800	600	67800	21 764	58000	800	15800	600	73800	21 845	57000	1000	12800	400	69800	22 615
Pyrène	3700	100	7700	20	11400	3 659	3900	20	8500	20	12400	3 670	6200	20	11000	20	17200	5 573
1-Méthylnaphtalène	440000	400	800	60	440800	141 497	350000	90	1200	90	351200	103 955	310000	400	800	70	310800	100 699
2-Méthylnaphtalène	540000	400	1000	50	541000	173 661	530000	80	1500	80	531500	157 324	440000	400	960	60	440960	142 871
1,3-Diméthylnaphtalène	480000	7000	3000	400	483000	155 043	520000	5000	4200	700	524200	155 163	350000	6000	1600	300	351600	113 918
HAP totaux	**1 869 000**		**44 220**		**1 913 220**	**614 144**	**1 910 207**		**52 740**		**1 962 947**	**581 032**	**1 525 092**		**56 180**		**1 581 272**	**512 332**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

MARTINVILLE - HIVER 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/05/31)			Jour 3 (1999/06/02)			Jour 5 (1999/06/04)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo[a]anthracène	ND	600	0	ND	400	0	ND	400	0
Chrysène	DNQ	600	0	DNQ	300	0	ND	400	0
Benzo[b]fluoranthène	ND	900	0	ND	700	0	ND	800	0
Benzo[j+k]fluoranthène	ND	800	0	ND	400	0	ND	400	0
Benzo[a]pyrène	ND	800	0	ND	500	0	ND	600	0
Indéno[1,2,3-c,d]pyrène	ND	1000	0	ND	1000	0	ND	1000	0
Dibenzo[ac]+[ah]anthracène	ND	300	0	ND	400	0	ND	600	0
5-méthylchrysène	ND	900	0	ND	500	0	ND	500	0
Dibenzo[a,h]acridine	ND	1000	0	ND	2000	0	ND	4000	0
Dibenzo[a,j]acridine			0	ND	2000	0	ND	3000	0
7H-Dibenzo[c,g]carbazole	ND	2000	0	ND	5000	0	ND	6000	0
Dibenzo[a,l]pyrène	ND	1000	0	ND	3000	0	ND	3000	0
Dibenzo[a,e]pyrène	ND	300	0	ND	500	0	ND	600	0
Dibenzo[a,i]pyrène	ND	1000	0	ND	5000	0	ND	6000	0
Dibenzo[a,h]pyrène	ND	1000	0	ND	3000	0	ND	3000	0
Sous total - groupe 1	**0**		**0**	**0**		**0**	**0**		**0**
HAP - groupe 2 et autres									
Acénaphtène	ND	10000	0	ND	5000	0	ND	4000	0
Acénaphthylène	ND	6000	0	DNQ	800	0	DNQ	700	0
Anthracène	ND	2000	0	ND	1000	0	ND	1000	0
Benzo(g,h,i)pérylène	ND	1000	0	ND	1000	0	ND	2000	0
Benzo(e)pyrène	ND	800	0	ND	500	0	ND	500	0
Fluoranthène	8100	800	15	6100	400	10	3600	400	5
Fluorène	ND	8000	0	4200	1000	7	1700	1000	2
Naphtalène	44000	5000	80	42000	900	65	29000	700	42
Pérylène	ND	800	0	ND	400	0	ND	500	0
Phénanthrène	17000	2000	31	18000	1000	28	13000	1000	19
Pyrène	3800	800	7	2500	400	4	1900	400	3
1-Méthylnaphtalène	23000	2000	42	38000	700	59	34000	700	50
2-Méthylnaphtalène	33000	2000	60	72000	800	112	61000	700	89
1,3-Diméthylnaphtalène	DNQ	4000	0	9400	1000	15	5100	1000	7
2-Chloronaphtalène	ND	600	0	ND	200	0	ND	200	0
1-Chloronaphtalène	ND	700	0	ND	200	0	ND	200	0
2,3,5-Triméthylnaphtalène	ND	5000	0	DNQ	1000	0	ND	1000	0
Carbazole	3800	400	7	2400	500	4	3100	700	5
2-Méthylfluoranthène	44000	5000	80	ND	600	0	ND	600	0
Benzo[c]phénanthrène	ND	900	0	ND	500	0	ND	500	0
Benzo[c]acridine	ND	300	0	ND	300	0	ND	300	0
Cyclopenta[c,d]pyrène	ND	600	0	ND	300	0	ND	300	0
2-Méthylchrysène	ND	600	0	ND	300	0	ND	300	0
3-Méthylchrysène	ND	600	0	ND	300	0	ND	300	0
4+6-Méthylchrysène	ND	500	0	ND	300	0	ND	300	0
1-Nitropyrène	ND	5000	0	ND	3000	0	ND	2000	0
7,12-Diméthylbenzo[a]anthracène	ND	3000	0	ND	800	0	ND	900	0
3-Méthylcholanthrène	ND	2000	0	ND	1000	0	ND	1000	0
Dibenzo[a,j]anthracène	ND	300	0	ND	400	0	ND	600	0
Anthanthrène	ND	2000	0	ND	2000	0	ND	3000	0
Dibenzo[a,e]fluoranthène	ND	1000	0	ND	2000	0	ND	2000	0
Coronène	ND	1000	0	ND	3000	0	ND	4000	0
HAP totaux	**176 700**		**322**	**194 600**		**303**	**152 400**		**223**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

CHÂTEAUGUAY - ÉTÉ 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo[a]anthracène	2500	800	95	2000	400	68	3000	600	104
Chrysène	7200	700	273	5600	400	190	7400	600	257
Benzo[b]fluoranthène	6200	400	235	6000	400	203	12000	400	417
Benzo[j+k]fluoranthène	4300	300	163	4200	300	142	9400	300	327
Benzo[a]pyrène	1800	400	68	1500	400	51	2100	400	73
Indéno[1,2,3-c,d]pyrène	1800	300	68	1500	300	51	1800	300	63
Dibenzo[ac]+[ah]anthracène	DNQ	200	0	480	100	16	710	100	25
5-méthylchrysène	ND	400	0	ND	200	0	ND	200	0
Dibenzo[a,h]acridine	ND	600	0	ND	400	0	ND	400	0
Dibenzo[a,j]acridine	ND	500	0	ND	400	0			0
7H-Dibenzo[c,g]carbazole	ND	700	0	ND	400	0	ND	400	0
Dibenzo[a,l]pyrène	DNQ	500	0	ND	400	0	ND	300	0
Dibenzo[a,e]pyrène	DNQ	100	0	DNQ	70	0	ND	50	0
Dibenzo[a,i]pyrène	ND	500	0	ND	400	0	ND	300	0
Dibenzo[a,h]pyrène	ND	500	0	ND	300	0	ND	200	0
Sous total - groupe 1	**23 800**		**902**	**21 280**		**720**	**36 410**		**1 265**
HAP - groupe 2 et autres									
Acénaphtène	5500	1000	209	4400	900	149	6600	2000	229
Acénaphthylène	DNQ	600	0	DNQ	500	0	DNQ	900	0
Anthracène	ND	4000	0	ND	2000	0	3100	900	108
Benzo(g,h,i)pérylène	2200	400	83	2200	300	74	2800	300	97
Benzo(e)pyrène	4600	400	174	4500	300	152	4000	400	139
Fluoranthène	12000	400	455	8300	300	281	14000	300	487
Fluorène	14000	400	531	11000	400	372	17000	600	591
Naphtalène	66000	700	2 502	37000	400	1 253	88000	1000	3 058
Pérylène	DNQ	400	0	ND	400	0	DNQ	300	0
Phénanthrène	46000	4000	1 744	34000	2000	1 151	22000	900	765
Pyrène	13000	400	493	11000	300	372	16000	300	556
1-Méthylnaphtalène	20000	200	758	12000	100	406	18000	200	626
2-Méthylnaphtalène	20000	200	758	15000	100	508	14000	200	487
1,3-Diméthylnaphtalène	24000	500	910	13000	300	440	15000	600	521
2-Chloronaphtalène	ND	30	0	ND	30	0	DNQ	20	0
1-Chloronaphtalène	ND	40	0	DNQ	40	0	DNQ	20	0
2,3,5-Triméthylnaphtalène	8500	300	322	6900	400	234	7000	500	243
Carbazole	7000	600	265	5700	400	193	14000	300	487
2-Méthylfluoranthène	1400	400	53	1100	300	37	1600	300	56
Benzo[c]phénanthrène	ND	1000	0	DNQ	600	0	ND	900	0
Benzo[c]acridine	DNQ	500	0	790	100	27	650	100	23
Cyclopenta[c,d]pyrène	ND	800	0	ND	300	0	ND	300	0
2-Méthylchrysène	1600	300	61	560	100	19	770	100	27
3-Méthylchrysène	DNQ	300	0	1400	100	47	1600	100	56
4+6-Méthylchrysène	ND	300	0	ND	100	0	ND	100	0
1-Nitropyrène	ND	3000	0	ND	3000	0	ND	1000	0
7,12-Diméthylbenzo[a]anthracène	ND	700	0	ND	700	0	ND	2000	0
3-Méthylcholanthrène	ND	700	0	ND	700	0	ND	900	0
Dibenzo[a,j]anthracène	ND	200	0	320	100	11	370	100	13
Anthanthrène	ND	700	0	ND	500	0	ND	500	0
Dibenzo[a,e]fluoranthène	ND	400	0	ND	300	0	ND	200	0
Coronène	DNQ	300	0	630	200	21	810	100	28
HAP totaux	**269 600**		**10 222**	**191 080**		**6 469**	**283 710**		**9 859**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

CUM - ÉTÉ 98

HAP : concentrations mesurées et charges

HAP	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo(a)anthracène	16000	700	36 368	7900	600	20 390	5900	800	12 945
Chrysène	23000	700	52 279	14000	700	36 134	11000	900	24 134
Benzo(b+j)fluoranthène	18000	400	40 914	15000	500	38 715	7300	400	16 016
Benzo(k)fluoranthène	5000	400	11 365	3800	400	9 808	2300	300	5 046
Benzo(a)pyrène	7400	400	16 820	6100	500	15 744	3500	500	7 679
Indéno-1,2,3(c,d)pyrène	4000	500	9 092	4100	300	10 582	2300	400	5 046
Dibenzo(a,h)anthracène	1200	300	2 728	1100	300	2 839	DNQ	300	0
Sous total - groupe 1	**74 600**		**169 566**	**52 000**		**134 212**	**32 300**		**70 866**
HAP - groupe 2 et autres									
Acénaphtène	48000	6000	109 104	33000	6000	85 173	34000	10000	74 596
Acénaphthylène (2)	ND	9000	0	ND	10000	0	ND	10000	0
Anthracène	22000	2000	50 006	15000	1000	38 715	11000	2000	24 134
Benzo(g,h,i)pérylène	4700	400	10 683	5600	300	14 454	3200	300	7 021
Benzo(e)pyrène	9400	400	21 366	8600	500	22 197	4800	400	10 531
Fluoranthène	74000	500	168 202	33000	600	85 173	25000	500	54 850
Fluorène	56000	3000	127 288	48000	4000	123 888	36000	900	78 984
Naphtalène (1)	700000	10000	1 591 100	540000	3000	1 393 740	390000	2000	855 660
Pérylène	1800	400	4 091	1300	400	3 355	DNQ	400	0
Phénanthrène	140000	1000	318 220	130000	1000	335 530	86000	2000	188 684
Pyrène	62000	600	140 926	36000	600	92 916	22000	600	48 268
1-Méthylnaphtalène (1)	770000	5000	1 750 210	680000	2000	1 755 080	180000	1000	394 920
2-Méthylnaphtalène (1)	500000	5000	1 136 500	700000	2000	1 806 700	210000	1000	460 740
1,3-Diméthylnaphtalène (1)	1600000	40000	3 636 800	730000	10000	1 884 130	83000	3000	182 102
HAP totaux	**4 062 500**		**9 234 063**	**3 012 500**		**7 775 263**	**1 117 300**		**2 451 356**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

(1) : Résultats des jours 1 et 3 sont émis à titre d'information car le pourcentage de récupération de l'analogue marqué utilisé pour la quantification de ces produits est inférieur aux limites acceptables selon les critères de contrôle de qualité du laboratoire.

(2) : Résultats du jour 5 est émis à titre d'information car le pourcentage de récupération de l'analogue marqué utilisé pour la quantification de ces produits est inférieur aux limites acceptables selon les critères de contrôle de qualité du laboratoire.

CUO - ÉTÉ 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/07/05-06)			Jour 3 (1999/07/07-08)			Jour 5 (1999/07/09-10)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo[a]anthracène	DNQ	600	0	970	200	132	650	100	103
Chrysène	3700	600	566	2300	200	313	2100	100	333
Benzo[b]fluoranthène	DNQ	400	0	1700	200	231	1200	100	190
Benzo[j+k]fluoranthène	DNQ	300	0	1300	100	177	990	80	157
Benzo[a]pyrène	ND	400	0	790	200	108	430	100	68
Indéno[1,2,3-c,d]pyrène	DNQ	90	0	510	100	69	370	60	59
Dibenzo[ac]+[ah]anthracène	110	20	17	110	20	15	140	20	22
5-méthylchrysène	ND	200	0	ND	100	0	ND	70	0
Dibenzo[a,h]acridine	ND	100	0	ND	90	0	ND	70	0
Dibenzo[a,j]acridine	ND	100	0			0	ND	50	0
7H-Dibenzo[c,g]carbazole	ND	100	0	ND	200	0	ND	60	0
Dibenzo[a,l]pyrène	ND	100	0	ND	100	0	ND	70	0
Dibenzo[a,e]pyrène	ND	20	0	ND	30	0	ND	20	0
Dibenzo[a,i]pyrène	ND	100	0	ND	100	0	ND	90	0
Dibenzo[a,h]pyrène	ND	90	0	ND	90	0	ND	60	0
Sous total - groupe 1	**3 810**		**583**	**7 680**		**1 046**	**5 880**		**931**
HAP - groupe 2 et autres									
Acénaphtène	ND	2000	0	DNQ	1000	0	DNQ	600	0
Acénaphthylène	DNQ	700	0	DNQ	500	0	DNQ	200	0
Anthracène	2200	400	336	DNQ	700	0	1100	300	174
Benzo(g,h,i)pérylène	410	100	63	740	100	101	550	70	87
Benzo(e)pyrène	1100	300	168	1100	200	150	900	90	143
Fluoranthène	5800	300	887	6600	200	898	3100	200	491
Fluorène	6300	900	963	7200	700	980	4600	200	728
Naphtalène	48000	700	7 340	46000	1000	6 262	20000	200	3 167
Pérylène	ND	400	0	DNQ	100	0	DNQ	90	0
Phénanthrène	19000	400	2 905	13000	700	1 770	10000	400	1 584
Pyrène	40000	300	6 117	25000	200	3 403	12000	200	1 900
1-Méthylnaphtalène	6800	300	1 040	7200	300	980	3700	80	586
2-Méthylnaphtalène	9100	300	1 392	10000	200	1 361	4200	80	665
1,3-Diméthylnaphtalène	5600	500	856	4300	400	585	2700	200	428
2-Chloronaphtalène	ND	80	0	ND	40	0	ND	20	0
1-Chloronaphtalène	ND	100	0	ND	40	0	ND	20	0
2,3,5-Triméthylnaphtalène	1400	400	214	3200	300	436	1800	200	285
Carbazole	ND	500	0	8100	100	1 103	5800	100	919
2-Méthylfluoranthène	DNQ	300	0	DNQ	200	0	350	100	55
Benzo[c]phénanthrène	ND	900	0	DNQ	300	0	DNQ	200	0
Benzo[c]acridine	DNQ	200	0	460	40	63	480	30	76
Cyclopenta[c,d]pyrène	ND	500	0	ND	200	0	ND	70	0
2-Méthylchrysène	850	100	130	350	80	48	240	40	38
3-Méthylchrysène	2000	100	306	940	80	128	600	40	95
4+6-Méthylchrysène	450	100	69	DNQ	80	0	DNQ	40	0
1-Nitropyrène	ND	4000	0	ND	2000	0	ND	800	0
7,12-Diméthylbenzo[a]anthracène	ND	600	0	ND	700	0	ND	600	0
3-Méthylcholanthrène	ND	800	0	ND	300	0	ND	300	0
Dibenzo[a,j]anthracène	DNQ	20	0	68	20	9	DNQ	20	0
Anthanthrène	ND	200	0	ND	200	0	ND	100	0
Dibenzo[a,e]fluoranthène	ND	80	0	ND	80	0	ND	50	0
Coronène	DNQ	90	0	ND	60	0	ND	40	0
HAP totaux	**152 820**		**23 368**	**141 938**		**19 322**	**78 000**		**12 353**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

CUQ (station Est) - ÉTÉ 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/07/05-06) [1]			Jour 3 (1999/07/07-08)			Jour 5 (1999/07/09-10)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo[a]anthracène	DNQ	2000	0	DNQ	2000	0	7900	2000	1 433
Chrysène	11000	2000	1 966	11000	2000	2 533	14000	2000	2 539
Benzo[b]fluoranthène	6800	900	1 215	6500	1000	1 497	6900	2000	1 251
Benzo[j+k]fluoranthène	4000	800	715	3000	900	691	4200	1000	762
Benzo[a]pyrène	2400	800	429	DNQ	1000	0	DNQ	2000	0
Indéno[1,2,3-c,d]pyrène	1900	300	340	DNQ	600	0	1900	300	345
Dibenzo[ac]+[ah]anthracène	690	100	123	ND	200	0	1200	200	218
5-méthylchrysène	ND	200	0	3700	300	852	ND	300	0
Dibenzo[a,h]acridine	ND	400	0	ND	800	0	ND	400	0
Dibenzo[a,j]acridine			0			0			0
7H-Dibenzo[c,g]carbazole	ND	600	0	ND	2000	0	ND	300	0
Dibenzo[a,l]pyrène	ND	400	0	ND	1000	0	DNQ	600	0
Dibenzo[a,e]pyrène	ND	90	0	ND	200	0	DNQ	100	0
Dibenzo[a,i]pyrène	ND	400	0	ND	1000	0	ND	800	0
Dibenzo[a,h]pyrène	ND	400	0	ND	900	0	ND	500	0
Sous total - groupe 1	**26 790**		**4 788**	**24 200**		**5 573**	**36 100**		**6 548**
HAP - groupe 2 et autres									
Acénaphtène	10000	1000	1 787	28000	900	6 449	6700	2000	1 215
Acénaphthylène	DNQ	500	0	ND	4000	0	DNQ	1000	0
Anthracène	ND	6000	0	6400	2000	1 474	3900	1000	707
Benzo(g,h,i)pérylène	2200	300	393	3000	700	691	2900	400	526
Benzo(e)pyrène	5300	800	947	5200	1000	1 198	6600	1000	1 197
Fluoranthène	26000	500	4 646	16000	400	3 685	21000	600	3 809
Fluorène	23000	900	4 110	65000	20000	14 970	18000	600	3 265
Naphtalène	130000	2000	23 232	310000	1000	71 395	36000	800	6 529
Pérylène	ND	800	0	ND	1000	0	DNQ	1000	0
Phénanthrène	50000	6000	8 935	63000	2000	14 509	39000	1000	7 074
Pyrène	25000	500	4 468	25000	400	5 758	30000	600	5 441
1-Méthylnaphtalène	84000	500	15 011	340000	3000	78 304	38000	100	6 892
2-Méthylnaphtalène	110000	500	19 658	310000	3000	71 395	48000	100	8 706
1,3-Diméthylnaphtalène	74000	800	13 224	290000	6000	66 789	50000	1000	9 069
2-Chloronaphtalène	ND	60	0	ND	30	0	ND	20	0
1-Chloronaphtalène	ND	70	0	ND	20	0	ND	20	0
2,3,5-Triméthylnaphtalène	24000	700	4 289	87000	6000	20 037	20000	700	3 627
Carbazole	14000	500	2 502	9500	300	2 188	11000	300	1 995
2-Méthylfluoranthène	4300	800	768	4900	400	1 129	5400	600	979
Benzo[c]phénanthrène	ND	2000	0	ND	2000	0	ND	3000	0
Benzo[c]acridine	ND	600	0	710	200	164	1100	300	200
Cyclopenta[c,d]pyrène	ND	800	0	DNQ	900	0	ND	1000	0
2-Méthylchrysène	2300	200	411	2300	200	530	2600	200	472
3-Méthylchrysène	5600	200	1 001	5700	200	1 313	6000	200	1 088
4+6-Méthylchrysène	950	200	170	1200	200	276	890	200	161
1-Nitropyrène	ND	5000	0	ND	5000	0	ND	4000	0
7,12-Diméthylbenzo[a]anthracène	ND	7000	0	ND	6000	0	ND	6000	0
3-Méthylcholanthrène	ND	2000	0	ND	3000	0	ND	4000	0
Dibenzo[a,j]anthracène	300	100	54	ND	200	0	DNQ	200	0
Anthanthrène	ND	500	0	ND	1000	0	ND	700	0
Dibenzo[a,e]fluoranthène	ND	300	0	ND	700	0	DNQ	400	0
Coronène	ND	300	0	ND	1000	0	1500	300	272
HAP totaux	**617 740**		**110 393**	**1 597 110**		**367 826**	**384 690**		**69 772**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

COOKSHIRE - ÉTÉ 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)[1]		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (mg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (mg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (mg/j)**
HAP - groupe 1									
Benzo[a]anthracène	ND	1000	0	ND	10000	0			
Chrysène	DNQ	1000	0	DNQ	10000	0			
Benzo[b]fluoranthène	ND	2000	0			0			
Benzo[j+k]fluoranthène	ND	2000	0	DNQ	3000	0			
Benzo[a]pyrène	DNQ	2000	0	ND	4000	0			
Indéno[1,2,3-c,d]pyrène	1900	500	4	DNQ	1000	0			
Dibenzo[ac]+[ah]anthracène	ND	200	0	ND	600	0			
5-méthylchrysène	ND	4000	0	ND	4000	0			
Dibenzo[a,h]acridine	ND	700	0	ND	1000	0			
Dibenzo[a,j]acridine			0			0			
7H-Dibenzo[c,g]carbazole	ND	1000	0	ND	3000	0			
Dibenzo[a,l]pyrène	ND	800	0	ND	1000	0			
Dibenzo[a,e]pyrène	ND	300	0	ND	300	0			
Dibenzo[a,i]pyrène	ND	800	0	ND	2000	0			
Dibenzo[a,h]pyrène	ND	700	0	ND	1000	0			
Sous total - groupe 1	**1 900**		**4**	**0**		**0**	**0**		**0**
HAP - groupe 2 et autres									
Acénaphtène	DNQ	1000	0	DNQ	900	0			
Acénaphthylène	ND	600	0	ND	700	0			
Anthracène	ND	2000	0	ND	1000	0			
Benzo(g,h,i)pérylène	7400	600	15	8300	2000	16			
Benzo(e)pyrène	DNQ	2000	0	DNQ	4000	0			
Fluoranthène	DNQ	9000	0	12000	2000	23			
Fluorène	2600	700	5	2200	500	4			
Naphtalène	DNQ	200	0	ND	200	0			
Pérylène	ND	2000	0	ND	4000	0			
Phénanthrène	28000	2000	55	30000	1000	58			
Pyrène	28000	9000	55	33000	2000	64			
1-Méthylnaphtalène	ND	100	0	700	80	1			
2-Méthylnaphtalène	ND	100	0	ND	80	0			
1,3-Diméthylnaphtalène	DNQ	500	0	2000	600	4			
2-Chloronaphtalène	ND	30	0	ND	20	0			
1-Chloronaphtalène	ND	40	0	ND	20	0			
2,3,5-Triméthylnaphtalène	DNQ	500	0	1500	500	3			
Carbazole	DNQ	900	0	2200	500	4			
2-Méthylfluoranthène	ND	9000	0	ND	3000	0			
Benzo[c]phénanthrène	ND	20000	0	ND	10000	0			
Benzo[c]acridine	ND	2000	0	ND	3000	0			
Cyclopenta[c,d]pyrène	ND	10000	0	ND	10000	0			
2-Méthylchrysène	DNQ	3000	0	DNQ	2000	0			
3-Méthylchrysène	13000	3000	26	9800	2000	19			
4+6-Méthylchrysène	ND	3000	0	ND	2000	0			
1-Nitropyrène	ND	40000	0	ND	40000	0			
7,12-Diméthylbenzo[a]anthracène	ND	20000	0	ND	20000	0			
3-Méthylcholanthrène	ND	6000	0	ND	9000	0			
Dibenzo[a,j]anthracène	ND	200	0	ND	600	0			
Anthanthrène	DNQ	1000	0	ND	3000	0			
Dibenzo[a,e]fluoranthène	ND	600	0	ND	900	0			
Coronène	5800	400	11	5200	600	10			
HAP totaux	**86 700**		**171**	**106 900**		**206**	**0**		**0**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : L'échantillon du jour 5 de Cookshire n'a pu être analysé car il était trop chargé en matière organique, ce qui faisait interférence et rendait impossible le dosage.

FARNHAM - ÉTÉ 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo[a]anthracène	1200	100	18	1100	100	17	2200	300	26
Chrysène	2700	100	40	2700	100	41	4900	300	59
Benzo[b]fluoranthène	3000	90	44	2400	100	36	4400	400	53
Benzo[j+k]fluoranthène	2400	80	35	2100	90	32	3600	300	43
Benzo[a]pyrène	1600	80	24	1300	100	20	2700	400	32
Indéno[1,2,3-c,d]pyrène	1300	50	19	1200	60	18	2300	200	27
Dibenzo[ac]+[ah]anthracène	400	20	6	330	30	5	620	80	7
5-méthylchrysène	ND	50	0	ND	70	0	ND	200	0
Dibenzo[a,h]acridine	ND	70	0	ND	100	0	ND	400	0
Dibenzo[a,j]acridine			0	ND	100	0	ND	300	0
7H-Dibenzo[c,g]carbazole	ND	100	0	ND	100	0	ND	400	0
Dibenzo[a,l]pyrène	690	80	10	550	100	8	1300	200	16
Dibenzo[a,e]pyrène	210	10	3	180	20	3	410	40	5
Dibenzo[a,i]pyrène	ND	80	0	ND	100	0	ND	300	0
Dibenzo[a,h]pyrène	ND	80	0	ND	100	0	ND	200	0
Sous total - groupe 1	**13 500**		**199**	**11 860**		**179**	**22 430**		**268**
HAP - groupe 2 et autres									
Acénaphtène	DNQ	1000	0	DNQ	800	0	DNQ	1000	0
Acénaphthylène	ND	700	0	DNQ	300	0	ND	400	0
Anthracène	ND	1000	0	DNQ	200	0	DNQ	600	0
Benzo(g,h,i)pérylène	1800	60	27	1700	80	26	3200	200	38
Benzo(e)pyrène	2300	80	34	1800	100	27	3500	400	42
Fluoranthène	6300	200	93	6800	200	103	11000	700	131
Fluorène	3300	1000	49	3000	200	45	5400	300	64
Naphtalène	11000	200	162	ND	100	0	ND	80	0
Pérylène	530	80	8	460	100	7	DNQ	400	0
Phénanthrène	15000	1000	221	15000	200	226	48000	600	573
Pyrène	8200	200	121	11000	200	166	13000	700	155
1-Méthylnaphtalène	3300	100	49	1600	40	24	2400	40	29
2-Méthylnaphtalène	6500	100	96	2500	40	38	4000	40	48
1,3-Diméthylnaphtalène	1800	300	27	2700	200	41	4000	300	48
2-Chloronaphtalène	ND	40	0	ND	10	0	ND	20	0
1-Chloronaphtalène	ND	40	0	ND	10	0	ND	20	0
2,3,5-Triméthylnaphtalène	1300	300	19	1300	200	20	2200	200	26
Carbazole	1300	70	19	1900	70	29	3900	200	47
2-Méthylfluoranthène	ND	200	0	370	100	6	DNQ	500	0
Benzo[c]phénanthrène	DNQ	200	0	DNQ	200	0	DNQ	400	0
Benzo[c]acridine	230	60	3	260	30	4	400	100	5
Cyclopenta[c,d]pyrène	ND	70	0	ND	90	0	ND	200	0
2-Méthylchrysène	340	30	5	410	40	6	920	100	11
3-Méthylchrysène	750	30	11	830	40	13	1800	100	21
4+6-Méthylchrysène	98	30	1	160	40	2	330	100	4
1-Nitropyrène	ND	1000	0	ND	700	0	ND	2000	0
7,12-Diméthylbenzo[a]anthracène	ND	600	0	ND	700	0	ND	2000	0
3-Méthylcholanthrène	ND	200	0	ND	400	0	ND	700	0
Dibenzo[a,j]anthracène	200	20	3	160	30	2	380	80	5
Anthanthrène	ND	100	0	DNQ	100	0	DNQ	400	0
Dibenzo[a,e]fluoranthène	360	60	5	330	60	5	640	100	8
Coronène	570	80	8	550	70	8	1000	200	12
HAP totaux	**78 678**		**1 159**	**64 690**		**976**	**128 500**		**1 534**

ND : non détecté. DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

JONQUIÈRE - ÉTÉ 98

HAP : concentrations mesurées et charges

HAP	Jour 1 (1998/09/14-15)			Jour 3 (1998/09/16-17)			Jour 5 (1998/09/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo(a)anthracène	1100	100	42	1100	100	51	1000	100	48
Chrysène	3500	100	133	2800	90	130	2600	100	124
Benzo(b+j)fluoranthène	3600	40	136	3000	60	139	2900	40	138
Benzo(k)fluoranthène	1100	40	42	1000	50	46	880	40	42
Benzo(a)pyrène	1400	50	53	1200	60	56	1100	50	52
Indéno-1,2,3(c,d)pyrène	1100	30	42	1000	40	46	890	40	42
Dibenzo(a,h)anthracène	270	30	10	200	30	9	230	30	11
Sous total - groupe 1	**12 070**		**458**	**10 300**		**476**	**9 600**		**456**
HAP - groupe 2 et autres									
Acénaphtène	DNQ	700	0	2500	700	116	DNQ	600	0
Acénaphthylène	ND	900	0	ND	1000	0	DNQ	500	0
Anthracène	ND	800	0	ND	1000	0	ND	1000	0
Benzo(g,h,i)perylène	1200	30	45	1000	30	46	1000	30	48
Benzo(e)pyrène	2100	40	80	1800	60	83	1800	40	86
Fluoranthène	4400	100	167	3800	100	176	3200	50	152
Fluorène	2000	300	76	2200	400	102	1900	200	90
Naphtalène	10000	300	379	8300	400	384	6300	100	300
Pérylène	280	40	11	300	40	14	220	40	10
Phénanthrène	8100	600	307	7400	700	342	5100	800	242
Pyrène	8600	100	326	8800	100	407	7600	60	361
1-Méthylnaphtalène	11000	200	417	11000	200	509	5000	100	238
2-Méthylnaphtalène	18000	200	682	17000	200	786	9000	100	428
1,3-Diméthylnaphtalène	16000	800	606	25000	2000	1 156	7500	500	357
HAP totaux	**93 750**		**3 554**	**99 400**		**4 598**	**58 220**		**2 768**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

LA PRAIRIE - ÉTÉ 99

HAP : concentrations mesurées et charges

HAP	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo[a]anthracène	2100	300	102	1800	300	80	1200	100	55
Chrysène	3600	300	175	2700	300	119	2400	100	110
Benzo[b]fluoranthène	2600	300	126	3600	200	159	1300	100	59
Benzo[j+k]fluoranthène	2700	300	131	3400	200	150	1300	80	59
Benzo[a]pyrène	2600	400	126	2200	200	97	1100	100	50
Indéno[1,2,3-c,d]pyrène	1900	100	92	1600	80	71	910	90	42
Dibenzo[ac]+[ah]anthracène	650	50	32	490	30	22	270	30	12
5-méthylchrysène	ND	200	0	ND	100	0	ND	100	0
Dibenzo[a,h]acridine	ND	300	0	ND	100	0	ND	90	0
Dibenzo[a,j]acridine	ND	200	0			0	ND	70	0
7H-Dibenzo[c,g]carbazole	ND	200	0	ND	200	0	ND	100	0
Dibenzo[a,l]pyrène	1200	300	58	940	100	42	550	80	25
Dibenzo[a,e]pyrène	350	50	17	320	30	14	180	10	8
Dibenzo[a,i]pyrène	ND	200	0	ND	100	0	ND	80	0
Dibenzo[a,h]pyrène	ND	200	0	ND	100	0	ND	80	0
Sous total - groupe 1	**17 700**		**858**	**17 050**		**754**	**9 210**		**421**
HAP - groupe 2 et autres									
Acénaphtène	DNQ	2000	0	DNQ	1000	0	DNQ	1000	0
Acénaphthylène	ND	700	0	ND	800	0	DNQ	500	0
Anthracène	ND	1000	0	DNQ	600	0	ND	900	0
Benzo(g,h,i)pérylène	2900	100	141	2100	90	93	1300	100	59
Benzo(e)pyrène	3200	300	155	3000	200	133	1600	90	73
Fluoranthène	11000	300	533	7800	400	345	9700	600	443
Fluorène	8400	800	407	4800	800	212	8000	300	366
Naphtalène	41000	500	1 987	8400	400	371	44000	400	2 010
Pérylène	1700	300	82	720	200	32	490	100	22
Phénanthrène	25000	1000	1 212	12000	600	531	20000	900	914
Pyrène	14000	300	679	9800	400	433	22000	600	1 005
1-Methylnaphtalène	5400	200	262	1300	90	57	4900	90	224
2-Methylnaphtalene	7500	200	364	1300	80	57	7300	90	334
1,3-Dimethylnaphtalène	4300	600	208	DNQ	700	0	4300	1000	196
2-Chloronaphtalène	ND	60	0	ND	50	0	ND	10	0
1-Chloronaphtalène	ND	70	0	ND	60	0	ND	10	0
2,3,5-Trimethylnaphtalene	2000	500	97	DNQ	800	0	DNQ	900	0
Carbazole	6400	600	310	6000	60	265	10000	200	457
2-Methylfluoranthene	DNQ	300	0	DNQ	300	0	DNQ	200	0
Benzo[c]phenanthrene	ND	500	0	ND	400	0	DNQ	200	0
Benzo[c]acridine	300	100	15	ND	200	0	DNQ	40	0
Cyclopenta[c,d]pyrène	ND	300	0	ND	200	0	ND	80	0
2-Methylchrysène	360	100	17	210	70	9	250	80	11
3-Methylchrysene	960	100	47	680	70	30	760	80	35
4+6-Methylchrysene	ND	100	0	ND	70	0	DNQ	80	0
1-Nitropyrène	ND	2000	0	ND	2000	0	ND	1000	0
7,12-Dimethylbenzo[a]anthracene	ND	400	0	ND	800	0	ND	500	0
3-Methylcholanthrene	ND	700	0	ND	400	0	ND	300	0
Dibenzo[a,j]anthracène	390	50	19	280	30	12	140	30	6
Anthanthrène	DNQ	200	0	ND	200	0	ND	200	0
Dibenzo[a,e]fluoranthène	660	200	32	440	90	19	270	40	12
Coronène	610	200	30	550	100	24	370	60	17
HAP totaux	**153 780**		**7 454**	**76 430**		**3 379**	**144 590**		**6 606**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

LONGUEUIL - ÉTÉ 98

HAP : concentrations mesurées et charges

HAP	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo(a)anthracène	3000	700	741	3300	800	924	2300	600	577
Chrysène	5500	700	1 359	6400	900	1 792	4400	500	1 103
Benzo(b+j)fluoranthène	3600	500	889	4000	400	1 120	3200	400	802
Benzo(k)fluoranthène	1500	500	371	1300	400	364	1100	300	276
Benzo(a)pyrène	2000	600	494	2200	500	616	1500	400	376
Indéno-1,2,3(c,d)pyrène	DNQ	600	0	1300	400	364	DNQ	400	0
Dibenzo(a,h)anthracène	ND	400	0	ND	300	0	ND	300	0
Sous total - groupe 1	**15 600**		**3 853**	**18 500**		**5 180**	**12 500**		**3 133**
HAP - groupe 2 et autres									
Acénaphtène	DNQ	3000	0	33000	10000	9 240	10000	3000	2 507
Acénaphthylène	ND	3000	0	ND	9000	0	ND	3000	0
Anthracène	DNQ	3000	0	8600	2000	2 408	4900	1000	1 228
Benzo(g,h,i)pérylène	1900	500	469	2200	400	616	1600	400	401
Benzo(e)pyrène	2600	600	642	3100	400	868	2300	300	577
Fluoranthène	9200	900	2 272	8200	500	2 296	6200	500	1 554
Fluorène	12000	900	2 964	32000	3000	8 960	12000	1000	3 008
Naphtalène (1)	1100000	4000	271 700	500000	5000	140 000	110000	3000	27 573
Pérylène	ND	600	0	DNQ	400	0	DNQ	300	0
Phénanthrène	39000	2000	9 633	77000	2000	21 560	49000	900	12 283
Pyrène	11000	900	2 717	13000	600	3 640	8400	600	2 106
1-Méthylnaphtalène (1)	290000	3000	71 630	490000	2000	137 200	180000	2000	45 120
2-Méthylnaphtalène (1)	290000	3000	71 630	460000	2000	128 800	160000	2000	40 107
1,3-Diméthylnaphtalène (1)	230000	7000	56 810	750000	10000	210 000	170000	5000	42 613
HAP totaux	**2 001 300**		**494 321**	**2 395 600**		**670 768**	**726 900**		**182 210**

ND : non détecté;   DNQ : détecté non quantifié,   NDR : détecté mais ne satisfait pas le rapport isotopique

(1) : Résultats est émis à titre d'information car le pourcentage de récupération de l'analogue marqué utilisé pour la quantification de ces produits est inférieur aux limites acceptables selon les critères de contrôle de qualité du laboratoire

SAINT-GÉDÉON - ÉTÉ 98

HAP : concentrations mesurées et charges

HAP	Jour 1 (1998/09/15)			Jour 3 (1998/09/17)			Jour 5 (1998/09/19)		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (mg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (mg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (mg/j)**
HAP - groupe 1									
Benzo(a)anthracène	320	100	0,2	290	80	0,1	290	70	0,2
Chrysène	1600	100	0,8	1600	80	0,8	1200	80	0,8
Benzo(b+j)fluoranthène	1200	60	0,6	1200	50	0,6	1100	40	0,7
Benzo(k)fluoranthène	310	60	0,1	310	50	0,1	250	40	0,2
Benzo(a)pyrène	270	70	0,1	270	60	0,1	220	50	0,1
Indéno-1,2,3(c,d)pyrène	490	60	0,2	550	60	0,3	440	50	0,3
Dibenzo(a,h)anthracène	DNQ	50	0,0	DNQ	50	0,0	DNQ	40	0,0
Sous total - groupe 1	**4 190**		**2,0**	**4 220**		**2,0**	**3 500**		**2,3**
HAP - groupe 2 et autres									
Acénaphtène	DNQ	600	0,0	DNQ	600	0,0	DNQ	600	0,0
Acénaphthylène	ND	600	0,0	ND	500	0,0	ND	600	0,0
Anthracène	DNQ	600	0,0	DNQ	700	0,0	DNQ	700	0,0
Benzo(g,h,i)pérylène	610	50	0,3	570	50	0,3	490	40	0,3
Benzo(e)pyrène	730	60	0,3	700	50	0,3	670	40	0,4
Fluoranthène	6100	100	2,9	5400	100	2,6	4100	80	2,7
Fluorène	3400	100	1,6	3300	200	1,6	2700	100	1,8
Naphtalène	2700	100	1,3	6500	100	3,1	5600	90	3,7
Pérylène	DNQ	70	0.0	DNQ	50	0,0	DNQ	40	0.0
Phénanthrène	11000	500	5,3	11000	500	5,3	9300	500	6,1
Pyrène	6700	100	3,2	3600	100	1,7	3600	90	2,4
1-Méthylnaphtalène	3900	80	1,9	4300	80	2,1	3600	60	2,4
2-Méthylnaphtalène	2800	70	1,3	4500	80	2,2	3800	60	2,5
1,3-Diméthylnaphtalène	7700	1000	3,7	4300	1000	2,1	5000	700	3,3
HAP totaux	**49 830**		**23,8**	**48 390**		**23,2**	**42 360**		**27,9**

ND : non détecté. DNQ : détecte non quantifié. NDR : détecté mais ne satisfait pas le rapport isotopique.

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HAP : concentrations mesurées et charges

HAP	Jour 1 (1998/09/21)			Jour 3 (1998/09/23)			Jour 5 (1998/09/25)		
	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (mg/j)
HAP - groupe 1									
Benzo(a)anthracène	DNQ	100	0,0	300	100	1,4	400	90	1,5
Chrysène	700	100	2,0	700	100	3,4	940	100	3,6
Benzo(b+j)fluoranthène	550	40	1,6	530	50	2,6	730	40	2,8
Benzo(k)fluoranthène	160	40	0,5	170	40	0,8	220	30	0,9
Benzo(a)pyrène	210	50	0,6	220	60	1,1	350	50	1,4
Indéno-1,2,3(c,d)pyrène	260	50	0,7	270	30	1,3	350	40	1,4
Dibenzo(a,h)anthracène	DNQ	40	0,0	DNQ	40	0,0	DNQ	40	0,0
Sous total - groupe 1	**1 880**		**5,3**	**2 190**		**10,6**	**2 990**		**11,6**
HAP - groupe 2 et autres									
Acénaphtène	ND	1000	0,0	3400	1000	16,4	ND	1000	0,0
Acénaphthylène	DNQ	900	0,0	ND	1000	0,0	1900	600	7,3
Anthracène	ND	700	0,0	ND	600	0,0	ND	1000	0,0
Benzo(g,h,i)pérylène	540	40	1,5	450	30	2,2	540	30	2,1
Benzo(e)pyrène	610	40	1,7	560	50	2,7	760	40	2,9
Fluoranthène	3500	100	9,9	3500	90	16,9	5100	100	19,7
Fluorène	4500	200	12,7	4400	300	21,2	6800	700	26,3
Naphtalène	6300	200	17,8	4000	100	19,3	7300	500	28,2
Pérylène	130	40	0,4	DNQ	50	0,0	170	30	0,7
Phénanthrène	35000	500	98,8	34000	50	163,9	23000	1000	88,9
Pyrène	4600	100	13,0	4700	90	22,7	7600	100	29,4
1-Méthylnaphtalène	7200	200	20,3	5600	70	27,0	7700	300	29,8
2-Méthylnaphtalène	7000	100	19,8	6200	70	29,9	7900	300	30,5
1,3-Diméthylnaphtalène	29000	3000	81,9	26000	2000	125,4	13000	4000	50,3
HAP totaux	**100 260**		**283**	**95 000**		**458**	**84 760**		**328**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

APPENDIX 12

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) INCLUDED IN THE WATER QUALITY CRITERIA (GROUP 1 AND 2)

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) INCLUDED IN THE WATER QUALITY CRITERIA (GROUP 1 AND 2)

GROUP 1 : HAP à considérer lors de l'évaluation du respect des critères de santé humaine pour les HAP totaux. Ces HAP présentent une évidence suffisante de cancérogénécité telle qu'elle est définie par l'IARC* (1987).

Benzo(a)anthracène
Benzo(b)fluoranthène
Benzo(j)fluoranthène
Benzo(k)fluoranthène
Benzo(a)pyrène
Chrysène
Dibenzo(a,h)acridine
Dibenzo(a,j)acridine
Dibenzo(a,h)anthracène
7H-dibenzo(c,g)carbazole
Dibenzo(a,e)pyrène
Dibenzo(a,h)pyrène
Dibenzo(a,i)pyrène
Dibenzo(a,l)pyrène
Indeno(1,2,3-cd)pyrène
5-méthylchrysène

GROUP 2 : HAP à considérer pour leurs effets toxiques ou leur potentiel de cancérogénécité. Ces HAP présentent une évidence limitée de cancérogénécité telle qu'elle est définie par l'IARC*. Ils ne font pas partie pour le moment des critères de santé humaine. Toutefois, certains d'entre eux possèdent des critères pour la protection de la vie aquatique, qui doivent aussi être respectés.

Acénaphtène
Acénaphtylène
Anthanthrène
Anthracène
Benzo(c)acridine
Benzo(g,h,i)pérylène
Benzo(c)phénanthrène
Benzo(e)pyrène
Carbazole
Coronène
Cyclopenta(c,d)pyrène
Dibenzo(a,c)anthracène
Dibenzo(a,j)anthracène
Dibenzo(a,e)fluoranthène
7,12-diméthylbenzo(a)anthracène
Fluoranthène
Fluorène
3-méthylcholanthrène
2-méthylchrysène
3-méthylchrysène
4-méthylchrysène
6-méthylchrysène
2-méthylfluoranthène
Naphtalène
1-nitropyrène
Phénanthrène
Pyrène
Pérylène

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* *International Agency for Research on Cancer*

APPENDIX 13

RESULTS OF ANALYSES FOR TRACE-LEVEL CHLORINATED DIOXINS AND FURANS

Winter sampling: pages 199 to 202
Summer sampling: pages 203 to 213

Explanatory note on the presentation of results in Appendix 13:

The analysis of organic substances at trace levels first requires separation of the dissolved and particulate phases from samples, followed by extraction and then purification of each phase.

During the 1996–97 sampling campaign, the purified dissolved and particulate phases were analysed separately. The tabulated results for chlorinated dioxins and furans at plants sampled in 1996 and 1997 therefore present the analytical results for both phases, plus the mathematical value of the sum of these two results, with the aim of obtaining the total concentration of the sample.

During the 1998–99 sampling campaign, in a cost-saving effort, the purified extracts of both phases were mixed and the total concentration was analysed from this combined extract. Consequently, the tabulated results of plants sampled in 1998 and 1999 present a single analytical result per sampling day.

CUQ (station Est) - HIVER 97

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1997/01/06-07)						Jour 3 (1997/01/08-09)						Jour 5 (1997/01/10-11)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dioxines chlorés																		
2,3,7,8-T$_4$CDD	ND	0,05	ND	0,07	0	0	ND	0,1	ND	0,08	0	0	ND	0,1	ND	0,1	0	0
1,2,3,7,8-P$_5$CDD [1]	ND	0,07	ND	0,04	0	0	ND	0,3	ND	0,05	0	0	ND	0,08	ND	0,05	0	0
1,2,3,4,7,8-H$_6$CDD [1]	ND	0,06	ND	0,04	0	0	ND	0,1	ND	0,04	0	0	ND	0,08	ND	0,08	0	0
1,2,3,6,7,8-H$_6$CDD [1]	ND	0,04	DNQ	0,03	0	0	ND	0,1	ND	0,03	0	0	ND	0,08	ND	0,06	0	0
1,2,3,7,8,9-H$_6$CDD [1]	ND	0,05	DNQ	0,03	0	0	ND	0,1	ND	0,03	0	0	ND	0,06	ND	0,06	0	0
1,2,3,4,6,7,8-H$_7$CDD	0,4	0,04	1,5	0,03	1,9	306	ND	0,2	1,9	0,03	1,9	287	ND	0,09	2,5	0,04	2,5	397
O$_8$CDD	0,88	0,03	10	0,03	10,88	1 755	1	0,1	13	0,05	14	2 117	0,67	0,05	19	0,05	19,67	3 127
Furanes chlorés																		
2,3,7,8-T$_4$CDF [1]	ND	0,04	ND	0,05	0	0	ND	0,08	ND	0,06	0	0	ND	0,04	DNQ	0,08	0	0
1,2,3,7,8-P$_5$CDF [1]	ND	0,06	ND	0,03	0	0	ND	0,3	ND	0,06	0	0	ND	0,06	ND	0,05	0	0
2,3,4,7,8-P$_5$CDF [1]	ND	0,05	ND	0,03	0	0	ND	0,2	ND	0,05	0	0	ND	0,06	ND	0,05	0	0
1,2,3,4,7,8-H$_6$CDF [1]	ND	0,04	ND	0,04	0	0	ND	0,1	ND	0,04	0	0	ND	0,04	ND	0,04	0	0
1,2,3,6,7,8-H$_6$CDF [1]	ND	0,03	ND	0,03	0	0	ND	0,07	ND	0,03	0	0	ND	0,03	ND	0,03	0	0
2,3,4,6,7,8-H$_6$CDF [1]	ND	0,04	DNQ	0,04	0	0	ND	0,09	ND	0,04	0	0	ND	0,04	ND	0,04	0	0
1,2,3,7,8,9-H$_6$CDF [1]	ND	0,04	ND	0,05	0	0	ND	0,1	ND	0,04	0	0	ND	0,04	ND	0,05	0	0
1,2,3,4,6,7,8,-H$_7$CDF	ND	0,04	ND	0,1	0	0	ND	0,1	ND	0,1	0	0	ND	0,06	ND	0,3	0	0
1,2,3,4,7,8,9-H$_7$CDF	ND	0,05	ND	0,2	0	0	ND	0,1	ND	0,2	0	0	ND	0,07	ND	0,4	0	0
O$_8$CDF	0,37	0,03	0,55	0,04	0,92	148	ND	0,1	0,64	0,03	0,64	97	ND	0,05	0,96	0,05	0,96	153
Total (dioxines + furanes)	**1,65**		**12,05**		**13,70**	**2 209**	**1,00**		**15,54**		**16,54**	**2 501**	**0,67**		**22,46**		**23,13**	**3 677**
Équivalent toxique total [2]	**0,0086**		**0,026**		**0,034**	**5,50**	**0,0010**		**0,033**		**0,034**	**5,09**	**0,0007**		**0,045**		**0,046**	**7,25**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1997/01/06-07)						Jour 3 (1997/01/08-09)						Jour 5 (1997/01/10-11)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dioxines chlorés																		
T$_4$CDD	ND	0,05	ND	0,07	0	0	ND	0,1	ND	0,08	0	0	ND	0,1	ND	0,1	0	0
P$_5$CDD	ND	0,07	ND	0,04	0	0	ND	0,3	ND	0,05	0	0	ND	0,08	0,16	0,05	0,16	25
H$_6$CDD	ND	0,04	ND	0,03	0	0	ND	0,1	ND	0,03	0	0	ND	0,06	ND	0,06	0	0
H$_7$CDD	0,54	0,04	2,7	0,03	3,24	523	ND	0,2	3,5	0,03	3,5	529	ND	0,09	4,9	0,04	4,9	779
O$_8$CDD	0,88	0,03	10	0,03	10,88	1 755	1	0,1	13	0,05	14	2 117	0,67	0,05	19	0,05	19,67	3 127
Sous-total (dioxines)	**1,42**		**12,70**		**14,12**	**2 277**	**1,00**		**16,50**		**17,50**	**2 647**	**0,67**		**24,06**		**24,73**	**3 932**
Furanes chlorés																		
T$_4$CDF	ND	0,04	ND	0,05	0	0	ND	0,08	ND	0,06	0	0	ND	0,04	ND	0,08	0	0
P$_5$CDF	ND	0,05	ND	0,03	0	0	ND	0,2	ND	0,05	0	0	ND	0,06	ND	0,05	0	0
H$_6$CDF	0,54	0,03	ND	0,03	0,54	87	ND	0,07	0,11	0,03	0,11	17	ND	0,03	0,17	0,03	0,17	27
H$_7$CDF	0,89	0,04	ND	0,1	0,89	144	ND	0,1	ND	0,1	0	0	ND	0,06	ND	0,3	0	0
O$_8$CDF	0,37	0,03	0,55	0,04	0,92	148	ND	0,1	0,64	0,03	0,64	97	ND	0,05	0,96	0,05	0,96	153
Sous-total (furanes)	**1,80**		**0,55**		**2,35**	**379**	**0,00**		**0,75**		**0,75**	**113**	**0,00**		**1,13**		**1,13**	**180**
Total (dioxines + furanes)	**3,22**		**13,25**		**16,47**	**2 656**	**1,00**		**17,25**		**18,25**	**2 760**	**0,67**		**25,19**		**25,86**	**4 111**

ND non détecté   DNQ détecté non quantifié,   NDR détecté mais ne satisfait pas le rapport isotopique

[1] Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres

[2] Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD

LA PRAIRIE - HIVER 96

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés	Jour 1 (1996/12/02-03)						Jour 3 (1996/12/04-05)						Jour 5 (1996/12/06-07)					
Congénères	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dioxines chlorés																		
2,3,7,8-T$_4$CDD	ND	0,06	ND	0,08	0	0	ND	0,02	ND	0,08	0	0	ND	0,05	ND	0,05	0	0
1,2,3,7,8-P$_5$CDD [1]	ND	0,04	ND	0,05	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
1,2,3,4,7,8-H$_6$CDD [1]	ND	0,07	ND	0,07	0	0	ND	0,03	ND	0,07	0	0	ND	0,05	ND	0,06	0	0
1,2,3,6,7,8-H$_6$CDD [1]	ND	0,05	ND	0,05	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
1,2,3,7,8,9-H$_6$CDD [1]	ND	0,05	ND	0,05	0	0	ND	0,02	ND	0,05	0	0	ND	0,04	ND	0,05	0	0
1,2,3,4,6,7,8-H$_7$CDD	DNQ	0,05	0,63	0,06	0,63	32	0,08	0,02	0,65	0,06	0,73	36	DNQ	0,05	0,84	0,05	0,84	38
O$_8$CDD	DNQ	0,07	4	0,06	4	201	0,22	0,01	4,2	0,08	4,42	217	0,19	0,05	5,6	0,06	5,79	263
Furanes chlorés																		
2,3,7,8-T$_4$CDF [1]	ND	0,07	ND	0,07	0	0	ND	0,03	ND	0,08	0	0	ND	0,06	ND	0,06	0	0
1,2,3,7,8-P$_5$CDF [1]	ND	0,04	ND	0,05	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
2,3,4,7,8-P$_5$CDF [1]	ND	0,04	ND	0,04	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
1,2,3,4,7,8-H$_6$CDF [1]	ND	0,04	ND	0,03	0	0	ND	0,01	ND	0,04	0	0	ND	0,03	ND	0,02	0	0
1,2,3,6,7,8-H$_6$CDF [1]	ND	0,03	ND	0,02	0	0	ND	0,01	ND	0,03	0	0	ND	0,02	ND	0,02	0	0
2,3,4,6,7,8-H$_6$CDF [1]	ND	0,01	ND	0,03	0	0	ND	0,01	ND	0,04	0	0	ND	0,03	ND	0,02	0	0
1,2,3,7,8,9-H$_6$CDF [1]	ND	0,04	ND	0,03	0	0	ND	0,01	ND	0,05	0	0	ND	0,03	ND	0,03	0	0
1,2,3,4,6,7,8,-H$_7$CDF	ND	0,04	ND	0,06	0	0	ND	0,02	ND	0,07	0	0	ND	0,04	ND	0,03	0	0
1,2,3,4,7,8,9-H$_7$CDF	ND	0,05	ND	0,07	0	0	ND	0,02	ND	0,09	0	0	ND	0,05	ND	0,04	0	0
O$_8$CDF	ND	0,05	ND	0,05	0,36	18	ND	0,02	0,3	0,06	0,3	15	ND	0,04	0,41	0,05	0,41	19
Total (dioxines + furanes)	**0,00**		**4,63**		**4,99**	**251**	**0,30**	**0,02**	**5,15**		**5,45**	**267**	**0,19**		**6,85**		**7,04**	**319**
Équivalent toxique total [2]	**0,0000**		**0,011**		**0,011**	**0,54**	**0,0010**		**0,011**		**0,012**	**0,59**	**0,0002**		**0,014**		**0,015**	**0,66**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés	Jour 1 (1996/12/02-03)						Jour 3 (1996/12/04-05)						Jour 5 (1996/12/06-07)					
Groupes homologues	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dioxines chlorés																		
T$_4$CDD	ND	0,06	ND	0,08	0	0	ND	0,02	ND	0,08	0	0	ND	0,05	ND	0,05	0	0
P$_5$CDD	ND	0,04	ND	0,05	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
H$_6$CDD	ND	0,05	ND	0,05	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
H$_7$CDD	ND	0,05	1,2	0,06	1,2	60	0,08	0,02	1,3	0,06	1,38	68	ND	0,05	1,6	0,05	1,6	73
O$_8$CDD	ND	0,07	4	0,06	4	201	0,22	0,01	4,2	0,08	4,42	217	0,19	0,05	5,6	0,06	5,79	263
Sous-total (dioxines)	**0,00**		**5,20**		**5,20**	**262**	**0,30**		**5,50**		**5,80**	**284**	**0,19**		**7,20**		**7,39**	**335**
Furanes chlorés																		
T$_4$CDF	ND	0,07	ND	0,07	0	0	ND	0,03	ND	0,08	0	0	ND	0,06	ND	0,06	0	0
P$_5$CDF	ND	0,04	ND	0,04	0	0	ND	0,02	ND	0,05	0	0	ND	0,03	ND	0,04	0	0
H$_6$CDF	ND	0,03	ND	0,02	0	0	ND	0,01	ND	0,03	0	0	ND	0,02	ND	0,02	0	0
H$_7$CDF	ND	0,04	ND	0,06	0	0	ND	0,02	ND	0,07	0	0	ND	0,04	0,23	0,03	0,23	10
O$_8$CDF	ND	0,05	ND	0,05	0	0	ND	0,02	0,3	0,06	0,3	15	ND	0,04	0,41	0,05	0,41	19
Sous-total (furanes)	**0,00**		**0,00**		**0,00**	**0**			**0,30**		**0,30**	**15**	**0,00**		**0,64**		**0,64**	**29**
Total (dioxines + furanes)	**0,00**		**5,20**		**5,20**	**262**	**0,30**		**5,80**		**6,10**	**299**	**0,19**		**7,84**		**8,03**	**364**

ND non détecté, DNQ détecté non quantifié, NDR détecté mais ne satisfait pas le rapport isotopique

[1] Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres

[2] Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD

LONGUEUIL - HIVER 96

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1996/12/09-10)						Jour 3 (1996/12/11-12)						Jour 5 (1996/12/13-14)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dioxines chlorés																		
2,3,7,8-T_4CDD	ND	0,04	ND	0,09	0	0	ND	0,03	ND	0,06	0	0	ND	0,04	ND	0,08	0	0
1,2,3,7,8-P_5CDD [1]	ND	0,02	ND	0,07	0	0	ND	0,02	ND	0,04	0	0	ND	0,01	ND	0,04	0	0
1,2,3,4,7,8-H_6CDD [1]	ND	0,03	ND	0,08	0	0	ND	0,03	ND	0,05	0	0	ND	0,02	ND	0,05	0	0
1,2,3,6,7,8-H_6CDD [1]	ND	0,02	ND	0,05	0	0	ND	0,02	ND	0,03	0	0	ND	0,01	ND	0,04	0	0
1,2,3,7,8,9-H_6CDD [1]	ND	0,02	ND	0,06	0	0	ND	0,02	ND	0,03	0	0	ND	0,02	ND	0,04	0	0
1,2,3,4,6,7,8-H_7CDD	0,07	0,02	1,4	0,1	1,47	472	DNQ	0,02	1,7	0,07	1,7	503	DNQ	0,02	1,7	0,05	1,7	551
O_8CDD	0,29	0,02	14	0,07	14,29	4 587	0,14	0,02	19	0,06	19,14	5 665	0,24	0,02	27	0,04	27,24	8 826
Furanes chlorés																		
2,3,7,8-T_4CDF [1]	ND	0,03	ND	0,08	0	0	ND	0,03	ND	0,06	0	0	ND	0,03	ND	0,06	0	0
1,2,3,7,8-P_5CDF [1]	ND	0,02	ND	0,06	0	0	ND	0,01	ND	0,03	0	0	ND	0,02	ND	0,04	0	0
2,3,4,7,8-P_5CDF [1]	ND	0,02	ND	0,06	0	0	ND	0,01	ND	0,03	0	0	ND	0,02	ND	0,04	0	0
1,2,3,4,7,8-H_6CDF [1]	ND	0,02	ND	0,06	0	0	ND	0,01	ND	0,05	0	0	ND	0,01	ND	0,04	0	0
1,2,3,6,7,8-H_6CDF [1]	ND	0,01	ND	0,04	0	0	ND	0,01	ND	0,04	0	0	ND	0,01	ND	0,03	0	0
2,3,4,6,7,8-H_6CDF [1]	ND	0,01	ND	0,05	0	0	ND	0,01	ND	0,04	0	0	ND	0,01	ND	0,03	0	0
1,2,3,7,8,9-H_6CDF [1]	ND	0,02	ND	0,07	0	0	ND	0,01	ND	0,06	0	0	ND	0,02	ND	0,04	0	0
1,2,3,4,6,7,8,-H_7CDF	ND	0,02	ND	0,1	0	0	ND	0,02	ND	0,1	0	0	ND	0,02	ND	0,1	0	0
1,2,3,4,7,8,9-H_7CDF	ND	0,03	ND	0,1	0	0	ND	0,02	ND	0,2	0	0	ND	0,02	ND	0,1	0	0
O_8CDF	ND	0,02	0,79	0,05	0,79	254	ND	0,02	1,4	0,08	1,4	414	DNQ	0,02	1,2	0,06	1,2	389
Total (dioxines + furanes)	**0,36**		**16,19**		**16,55**	**5 313**	**0,14**		**22,10**		**22,24**	**6 583**	**0,24**		**29,90**		**30,14**	**9 765**
Équivalent toxique total [2]	**0,0010**		**0,029**		**0,030**	**9,56**	**0,0001**		**0,037**		**0,038**	**11,10**	**0,0002**		**0,045**		**0,045**	**14,72**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1996/12/09-10)						Jour 3 (1996/12/11-12)						Jour 5 (1996/12/13-14)					
	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)	Conc. Dissous (pg/L)	LDM (pg/L)	Conc. Partic. (pg/L)	LDM (pg/L)	Conc. Totale (pg/L)	Charge Totale (µg/j)
Dioxines chlorés																		
T_4CDD	ND	0,04	ND	0,09	0	0	ND	0,03	ND	0,06	0	0	ND	0,04	ND	0,08	0	0
P_5CDD	ND	0,02	ND	0,07	0	0	ND	0,02	ND	0,04	0	0	ND	0,01	ND	0,04	0	0
H_6CDD	ND	0,02	ND	0,05	0	0	ND	0,02	0,13	0,03	0,13	38	ND	0,01	ND	0,04	0	0
H_7CDD	0,07	0,02	2,8	0,1	2,87	921	ND	0,02	3	0,07	3	888	ND	0,02	3,2	0,05	3,2	1 037
O_8CDD	0,29	0,02	14	0,07	14,29	4 587	0,14	0,02	19	0,06	19,14	5 665	0,24	0,02	27	0,04	27,24	8 826
Sous-total (dioxines)	**0,36**		**16,80**		**17,16**	**5 508**	**0,14**		**22,13**		**22,27**	**6 592**	**0,24**		**30,20**		**30,44**	**9 863**
Furanes chlorés																		
T_4CDF	ND	0,03	ND	0,08	0	0	ND	0,03	ND	0,06	0	0	ND	0,03	ND	0,06	0	0
P_5CDF	ND	0,02	ND	0,06	0	0	ND	0,0[illegible]	ND	0,03	0	0	ND	0,02	ND	0,04	0	0
H_6CDF	ND	0,01	ND	0,04	0	0	ND	0,01	0,17	0,04	0,17	50	ND	0,01	0,13	0,03	0,13	42
H_7CDF	ND	0,02	ND	0,1	0	0	ND	0,02	ND	0,1	0	0	ND	0,02	ND	0,1	0	0
O_8CDF	ND	0,02	0,79	0,05	0,79	254	ND	0,02	1,4	0,08	1,4	414	ND	0,02	1,2	0,06	1,2	389
Sous-total (furanes)			**0,79**		**0,79**	**254**	**0,00**		**1,57**		**1,57**	**465**	**0,00**		**1,33**		**1,33**	**431**
Total (dioxines + furanes)	**0,36**		**17,59**		**17,95**	**5 762**	**0,14**		**23,70**		**23,84**	**7 057**	**0,24**		**31,53**		**31,77**	**10 293**

ND : non détecté   DNQ : détecté non quantifié   **NDR** : détecté mais ne satisfait pas le rapport isotopique

[1] Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres

[2] Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD

MARTINVILLE - HIVER 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1999/05/31)			Jour 3 (1999/06/02)			Jour 5 (1999/06/04)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	0,02	0,0	ND	0,3	0,0	ND	0,3	0,0
1,2,3,7,8-P_5CDD [1]	ND	0,03	0,0	ND	0,01	0,0	ND	0,03	0,0
1,2,3,4,7,8-H_6CDD [1]	ND	0,05	0,0	ND	0,03	0,0	ND	0,05	0,0
1,2,3,6,7,8-H_6CDD [1]	ND	0,03	0,0	ND	0,02	0,0	ND	0,04	0,0
1,2,3,7,8,9-H_6CDD [1]	ND	0,03	0,0	ND	0,02	0,0	ND	0,03	0,0
1,2,3,4,6,7,8-H_7CDD	1,3	0,02	2,4	0,17	0,01	0,3	0,16	0,03	0,2
O_8CDD	20	0,03	36,4	0,92	0,02	1,4	1,1	0,1	1,6
Furanes chlorés									
2,3,7,8-T_4CDF [1]	0,15	0,03	0,3	ND	0,03	0,0	DNQ	0,04	0,0
1,2,3,7,8-P_5CDF [1]	ND	0,03	0,0	ND	0,02	0,0	ND	0,05	0,0
2,3,4,7,8-P_5CDF [1]	DNQ	0,03	0,0	ND	0,02	0,0	ND	0,04	0,0
1,2,3,4,7,8-H_6CDF [1]	ND	0,03	0,0	DNQ	0,01	0,0	ND	0,02	0,0
1,2,3,6,7,8-H_6CDF [1]	DNQ	0,02	0,0	ND	0,01	0,0	ND	0,02	0,0
2,3,4,6,7,8-H_6CDF [1]	ND	0,02	0,0	ND	0,01	0,0	ND	0,02	0,0
1,2,3,7,8,9-H_6CDF [1]	ND	0,03	0,0	ND	0,02	0,0	ND	0,02	0,0
1,2,3,4,6,7,8,-H_7CDF	ND	0,06	0,0	ND	0,02	0,0	ND	0,04	0,0
1,2,3,4,7,8,9-H_7CDF	ND	0,06	0,0	ND	0,02	0,0	ND	0,04	0,0
O_8CDF	0,38	0,02	0,7	ND	0,01	0,0	ND	0,07	0,0
Total (dioxines + furanes)	**21,83**		**39,8**	**1,09**		**1,7**	**1,26**		**1,8**
Équivalent toxique total [2]	**0,048**		**0,087**	**0,003**		**0,005**	**0,003**		**0,004**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1999/05/31)			Jour 3 (1999/06/02)			Jour 5 (1999/06/04)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T_4CDD	0,93	0,02	1,7	ND	0,3	0,0	ND	0,3	0,0
P_5CDD	0,1	0,03	0,2	ND	0,01	0,0	ND	0,03	0,0
H_6CDD	ND	0,03	0,0	ND	0,02	0,0	ND	0,03	0,0
H_7CDD	2,6	0,02	4,7	0,17	0,01	0,3	0,28	0,03	0,4
O_8CDD	20	0,02	36,4	0,92	0,02	1,4	1,1	0,1	1,6
Sous-total (dioxines)	**23,63**		**43,0**	**1,09**		**1,7**	**1,38**		**2,0**
Furanes chlorés									
T_4CDF	0,15	0,03	0,3	ND	0,03	0,0	ND	0,04	0,0
P_5CDF	0,13	0,03	0,2	ND	0,02	0,0	ND	0,04	0,0
H_6CDF	ND	0,02	0,0	ND	0,01	0,0	ND	0,02	0,0
H_7CDF	0,19	0,06	0,3	ND	0,02	0,0	ND	0,04	0,0
O_8CDF	0,38	0,02	0,7	ND	0,01	0,0	ND	0,07	0,0
Sous-total (furanes)	**0,85**		**1,5**	**0,00**		**0,0**	**0,00**		**0,0**
Total (dioxines + furanes)	**24,48**		**44,6**	**1,09**		**1,7**	**1,38**		**2,0**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD.

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CHÂTEAUGUAY - ÉTÉ 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T$_4$CDD	ND	0,3	0	ND	0,2	0	ND	0,1	0
1,2,3,7,8-P$_5$CDD [1]	NDR	0,03	0	DNQ	0,03	0	ND	0,03	0
1,2,3,4,7,8-H$_6$CDD [1]	DNQ	0,02	0	ND	0,04	0	ND	0,03	0
1,2,3,6,7,8-H$_6$CDD [1]	0,13	0,02	5	ND	0,04	0	0,1	0,02	3
1,2,3,7,8,9-H$_6$CDD [1]	0,12	0,02	5	ND	0,03	0	0,09	0,02	3
1,2,3,4,6,7,8-H$_7$CDD	2,3	0,02	87	1,4	0,02	47	1,7	0,02	59
O$_8$CDD	23	0,02	872	9,7	0,03	328	13	0,03	452
Furanes chlorés									
2,3,7,8-T$_4$CDF [1]	DNQ	0,03	0	DNQ	0,04	0	ND	0,04	0
1,2,3,7,8-P$_5$CDF [1]	ND	0,03	0	ND	0,05	0	ND	0,04	0
2,3,4,7,8-P$_5$CDF [1]	ND	0,03	0	ND	0,05	0	ND	0,04	0
1,2,3,4,7,8-H$_6$CDF [1]	ND	0,02	0	ND	0,03	0	NDR	0,02	0
1,2,3,6,7,8-H$_6$CDF [1]	ND	0,02	0	ND	0,02	0	DNQ	0,01	0
2,3,4,6,7,8-H$_6$CDF [1]	ND	0,02	0	ND	0,02	0	ND	0,02	0
1,2,3,7,8,9-H$_6$CDF [1]	ND	0,02	0	ND	0,03	0	ND	0,02	0
1,2,3,4,6,7,8,-H$_7$CDF	NDR	0,2	0	NDR	0,1	0	NDR	0,2	0
1,2,3,4,7,8,9-H$_7$CDF	ND	0,3	0	ND	0,2	0	ND	0,2	0
O$_8$CDF	1,6	0,03	61	0,57	0,04	19	0,9	0,03	31
Total (dioxines + furanes)	**27,15**		**1 029**	**11,67**		**395**	**15,79**		**549**
Équivalent toxique total [2]	**0,073**		**2,8**	**0,024**		**0,8**	**0,050**		**1,7**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T$_4$CDD	3,9	0,3	148	3,9	0,2	132	4	0,1	139
P$_5$CDD	ND	0,03	0	ND	0,03	0	0,18	0,03	6
H$_6$CDD	0,79	0,02	30	0,24	0,03	8	0,19	0,02	7
H$_7$CDD	4,4	0,02	167	2,5	0,02	85	3,1	0,02	108
O$_8$CDD	23	0,02	872	9,7	0,03	328	13	0,03	452
Sous-total (dioxines)	**32,09**		**1 217**	**16,34**		**553**	**20,47**		**711**
Furanes chlorés									
T$_4$CDF	ND	0,03	0	ND	0,04	0	ND	0,04	0
P$_5$CDF	0,25	0,03	9	ND	0,05	0	ND	0,04	0
H$_6$CDF	0,08	0,02	3	0,14	0,02	5	ND	0,01	0
H$_7$CDF	ND	0,2	0	ND	0,1	0	ND	0,2	0
O$_8$CDF	1,6	0,03	61	0,57	0,04	19	0,9	0,03	31
Sous-total (furanes)	**1,93**		**73**	**0,71**		**24**	**0,90**		**31**
Total (dioxines + furanes)	**34,02**		**1 290**	**17,05**		**577**	**21,37**		**743**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD

CUM - ÉTÉ 98

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	1	0	ND	0,8	0	ND	0,3	0
1,2,3,7,8-P_5CDD [1]	ND	0,4	0	ND	0,5	0	ND	0,2	0
1,2,3,4,7,8-H_6CDD [1]	ND	0,5	0	ND	0,4	0	ND	0,02	0
1,2,3,6,7,8-H_6CDD [1]	ND	0,3	0	ND	0,2	0	ND	0,01	0
1,2,3,7,8,9-H_6CDD [1]	ND	0,3	0	1,2	0,2	3 097	0,53	0,01	1 163
1,2,3,4,6,7,8-H_7CDD	4,1	0,1	9 319	4,9	0,2	12 647	3,7	0,1	8 118
O_8CDD	31	0,05	70 463	29	0,2	74 849	24	0,01	52 656
Furanes chlorés									
2,3,7,8-T_4CDF [1]	2	0,3	4 546	2	0,4	5 162	ND	0,4	0
1,2,3,7,8-P_5CDF [1]	ND	0,2	0	ND	0,5	0	ND	0,2	0
2,3,4,7,8-P_5CDF [1]	NDR	0,2	0	ND	0,5	0	ND	0,2	0
1,2,3,4,7,8-H_6CDF [1]	ND	0,2	0	ND	0,2	0	ND	0,01	0
1,2,3,6,7,8-H_6CDF [1]	ND	0,1	0	ND	0,1	0	ND	0,01	0
2,3,4,6,7,8-H_6CDF [1]	ND	0,2	0	ND	0,2	0	ND	0,01	0
1,2,3,7,8,9-H_6CDF [1]	ND	0,2	0	ND	0,2	0	ND	0,01	0
1,2,3,4,6,7,8,-H_7CDF	ND	0,5	0	ND	0,5	0	NDR	0,5	0
1,2,3,4,7,8,9-H_7CDF	ND	0,6	0	ND	0,6	0	ND	0,7	0
O_8CDF	8,3	0,2	18 866	9,3	0,2	24 003	4	0,01	8 776
Total (dioxines + furanes)	**45,40**		**103 194**	**46,40**		**119 758**	**32,23**		**70 713**
Équivalent toxique total [2]	**0,280**		**636,4**	**0,407**		**1 050,5**	**0,118**		**258,9**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T_4CDD	ND	1	0	ND	0,8	0	ND	0,3	0
[illegible]DD	ND	0,4	0	ND	0,5	0	ND	0,2	0
H_6CDD	1	0,3	2 273	1,2	0,2	3 097	0,53	0,01	1 163
H_7CDD	8,1	0,1	18 411	8	0,2	20 648	3,7	0,1	8 118
O_8CDD	31	0,05	70 463	29	0,2	74 849	24	0,01	52 656
Sous-total (dioxines)	**40,10**		**91 147**	**38,20**		**98 594**	**28,23**		**61 937**
Furanes chlorés									
T_4CDF	2	0,3	4 546	ND	0,4	0	ND	0,4	0
P_5CDF	ND	0,2	0	ND	0,5	0	ND	0,2	0
H_6CDF	ND	0,1	0	ND	0,1	0	ND	0,01	0
H_7CDF	ND	0,5	0	ND	0,5	0	ND	0,5	0
O_8CDF	8,3	0,2	18 866	9,3	0,2	24 003	4	0,01	8 776
Sous-total (furanes)	**10,30**		**23 412**	**9,30**		**24 003**	**4,00**		**8 776**
Total (dioxines + furanes)	**50,40**		**114 559**	**47,50**		**122 598**	**32,23**		**70 713**

ND : non détecté;   DNQ : détecté non quantifié;   NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD.

CUO - ÉTÉ 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1999/07/05-06)			Jour 3 (1999/07/07-08)			Jour 5 (1999/07/09-10)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	0,05	0	ND	0,04	0	ND	0,08	0
1,2,3,7,8-P_5CDD [1]	ND	0,02	0	DNQ	0,02	0	DNQ	0,02	0
1,2,3,4,7,8-H_6CDD [1]	ND	0,02	0	ND	0,03	0	ND	0,03	0
1,2,3,6,7,8-H_6CDD [1]	ND	0,01	0	ND	0,02	0	DNQ	0,02	0
1,2,3,7,8,9-H_6CDD [1]	NDR	0,01	0	ND	0,02	0	ND	0,02	0
1,2,3,4,6,7,8-H_7CDD	0,49	0,01	75	0,57	0,02	78	0,8	0,02	127
O_8CDD	3,1	0,02	474	4,1	0,02	558	5,3	0,03	839
Furanes chlorés									
2,3,7,8-T_4CDF [1]	ND	0,03	0	ND	0,04	0	ND	0,04	0
1,2,3,7,8-P_5CDF [1]	ND	0,03	0	ND	0,04	0	ND	0,02	0
2,3,4,7,8-P_5CDF [1]	ND	0,03	0	ND	0,03	0	ND	0,02	0
1,2,3,4,7,8-H_6CDF [1]	ND	0,01	0	ND	0,02	0	ND	0,04	0
1,2,3,6,7,8-H_6CDF [1]	ND	0,01	0	ND	0,02	0	ND	0,03	0
2,3,4,6,7,8-H_6CDF [1]	DNQ	0,01	0	ND	0,02	0	ND	0,04	0
1,2,3,7,8,9-H_6CDF [1]	ND	0,01	0	ND	0,02	0	ND	0,04	0
1,2,3,4,6,7,8,-H_7CDF	NDR	0,02	0	NDR	0,05	0	NDR	0,03	0
1,2,3,4,7,8,9-H_7CDF	ND	0,03	0	ND	0,06	0	ND	0,03	0
O_8CDF	0,26	0,01	40	0,34	0,02	46	0,44	0,01	70
Total (dioxines + furanes)	**3,85**		**589**	**5,01**		**682**	**6,54**		**1 036**
Équivalent toxique total [2]	**0,008**		**1,3**	**0,010**		**1,4**	**0.014**		**2,2**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1999/07/05-06)			Jour 3 (1999/07/07-08)			Jour 5 (1999/07/09-10)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T_4CDD	1,3	0,05	199	1,5	0,04	204	ND	0,08	0
P_5CDD	ND	0,02	0	ND	0,02	0	ND	0,02	0
H_6CDD	0,06	0,01	9	ND	0,02	0	0,15	0,02	24
H_7CDD	0,9	0,01	138	1	0,02	136	1,4	0,02	222
O_8CDD	3,1	0,02	474	4,1	0,02	558	5,3	0,03	839
Sous-total (dioxines)	**5,36**		**820**	**6,60**		**898**	**6,85**		**1 085**
Furanes chlorés									
T_4CDF	ND	0,03	0	ND	0,04	0	ND	0,04	0
P_5CDF	ND	0,03	0	0,15	0,03	20	0,17	0,02	27
H_6CDF	ND	0,01	0	ND	0,02	0	0,14	0,03	22
H_7CDF	ND	0,02	0	ND	0,05	0	ND	0,03	0
O_8CDF	0,26	0,01	40	0,34	0,02	46	0,44	0,01	70
Sous-total (furanes)	**0,26**		**40**	**0,49**		**67**	**0,75**		**119**
Total (dioxines + furanes)	**5,62**		**859**	**7,09**		**965**	**7,60**		**1 204**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD.

CUQ (station Est) - ÉTÉ 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	**Jour 1 (1999/07/05-06)**			**Jour 3 (1999/07/07-08)**			**Jour 5 (1999/07/09-10)**		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	0,03	0	ND	0,08	0	ND	0,08	0
1,2,3,7,8-P_5CDD [1]	ND	0,03	0	ND	0,06	0	0,09	0,02	16
1,2,3,4,7,8-H_6CDD [1]	DNQ	0,03	0	ND	0,2	0	ND	0,05	0
1,2,3,6,7,8-H_6CDD [1]	0,21	0,02	38	ND	0,1	0	NDR	0,03	0
1,2,3,7,8,9-H_6CDD [1]	0,18	0,02	32	ND	0,2	0	NDR	0,03	0
1,2,3,4,6,7,8-H_7CDD	3,5	0,02	625	4,2	0,2	967	3	0,04	544
O_8CDD	27	0,05	4 825	31	0,04	7 140	24	0,05	4 353
Furanes chlorés									
2,3,7,8-T_4CDF [1]	0,18	0,05	32	ND	0,05	0	DNQ	0,04	0
1,2,3,7,8-P_5CDF [1]	ND	0,05	0	ND	0,04	0	ND	0,05	0
2,3,4,7,8-P_5CDF [1]	0,15	0,04	27	ND	0,04	0	ND	0,04	0
1,2,3,4,7,8-H_6CDF [1]	NDR	0,03	0	DNQ	0,1	0	DNQ	0,06	0
1,2,3,6,7,8-H_6CDF [1]	0,061	0,02	11	ND	0,08	0	ND	0,04	0
2,3,4,6,7,8-H_6CDF [1]	0,1	0,03	18	ND	0,1	0	ND	0,05	0
1,2,3,7,8,9-H_6CDF [1]	ND	0,03	0	ND	0,1	0	ND	0,06	0
1,2,3,4,6,7,8,-H_7CDF	NDR	0,1	0	NDR	0,3	0	NDR	0,2	0
1,2,3,4,7,8,9-H_7CDF	ND	0,2	0	ND	0,4	0	ND	0,3	0
O_8CDF	2,5	0,02	447	3,1	0,03	714	2,2	0,05	399
Total (dioxines + furanes)	**33,88**		**6 055**	**38,30**		**8 821**	**29,29**		**5 312**
Équivalent toxique total [2]	**0,213**		**38,0**	**0,076**		**17,5**	**0,101**		**18,4**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	**Jour 1 (1999/07/05-06)**			**Jour 3 (1999/07/07-08)**			**Jour 5 (1999/07/09-10)**		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dioxines chlorés									
T_4CDD	2,2	0,03	393	1,9	0,08	438	3,8	0,08	689
P_5CDD	0,18	0,03	32	ND	0,06	0	0,29	0,02	53
H_6CDD	1,4	0,02	250	0,6	0,1	138	0,42	0,03	76
H_7CDD	6,5	0,02	1 162	7,5	0,2	1 727	5,7	0,04	1 034
O_8CDD	27	0,02	4 825	31	0,04	7 140	24	0,05	4 353
Sous-total (dioxines)	**37,28**		**6 662**	**41,00**		**9 443**	**34,21**		**6 205**
Furanes chlorés									
T_4CDF	0,18	0,05	32	ND	0,05	0	ND	0,04	0
P_5CDF	0,49	0,04	88	0,3	0,04	69	0,44	0,04	80
H_6CDF	0,96	0,02	172	0,55	0,08	127	0,38	0,04	69
H_7CDF	1	0,1	179	1,5	0,3	345	0,9	0,2	163
O_8CDF	2,5	0,02	447	3,1	0,03	714	2,2	0,05	399
Sous-total (furanes)	**5,13**		**917**	**5,45**		**1 255**	**3,92**		**711**
Total (dioxines + furanes)	**42,41**		**7 579**	**46,45**		**10 698**	**38,13**		**6 916**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD.

COOKSHIRE - ÉTÉ 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	0,03	0,0	ND	0,08	0,0	ND	0,09	0,0
1,2,3,7,8-P_5CDD [1]	0,33	0,04	0,7	0,51	0,08	1,0	0,46	0,06	0,9
1,2,3,4,7,8-H_6CDD [1]	0,53	0,07	1,0	0,7	0,1	1,3	0,7	0,2	1,4
1,2,3,6,7,8-H_6CDD [1]	1,6	0,05	3,2	1,5	0,08	2,9	2,2	0,1	4,3
1,2,3,7,8,9-H_6CDD [1]	1,2	0,05	2,4	1,2	0,08	2,3	1,8	0,1	3,5
1,2,3,4,6,7,8-H_7CDD	15	0,02	29,7	18	0,2	34,7	22	0,1	43,0
O_8CDD	58	0,03	114,7	61	0,1	117,6	71	0,1	138,7
Furanes chlorés									
2,3,7,8-T_4CDF [1]	8	0,03	15,8	7,5	0,08	14,5	9,5	0,08	18,6
1,2,3,7,8-P_5CDF [1]	0,58	0,06	1,1	ND	0,1	0,0	ND	0,1	0,0
2,3,4,7,8-P_5CDF [1]	0,97	0,05	1,9	NDR	0,1	0,0	1,4	0,1	2,7
1,2,3,4,7,8-H_6CDF [1]	0,53	0,03	1,0	0,61	0,09	1,2	0,8	0,2	1,6
1,2,3,6,7,8-H_6CDF [1]	0,45	0,02	0,9	0,54	0,06	1,0	0,6	0,1	1,2
2,3,4,6,7,8-H_6CDF [1]	2,8	0,02	5,5	4,1	0,07	7,9	4,7	0,1	9,2
1,2,3,7,8,9-H_6CDF [1]	ND	0,03	0,0	ND	0,09	0,0	ND	0,2	0,0
1,2,3,4,6,7,8,-H_7CDF	3,1	0,06	6,1	2,9	0,2	5,6	3,7	0,2	7,2
1,2,3,4,7,8,9-H_7CDF	0,64	0,07	1,3	DNQ	0,3	0,0	DNQ	0,3	0,0
O_8CDF	3,3	0,03	6,5	3	0,09	5,8	3,5	0,06	6,8
Total (dioxines + furanes)	**97,03**		**192**	**101,56**		**196**	**122,36**		**239**
Équivalent toxique total [2]	**2,439**		**4,8**	**2,143**		**4,1**	**3,292**		**6,4**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**	**Conc. (pg/L)**	**LDM (pg/L)**	**Charge (µg/j)**
Dioxines chlorés									
T_4CDD	7,4	0,03	15	8,1	0,08	16	10	0,09	20
P_5CDD	3,3	0,04	7	2,8	0,08	5	1,8	0,06	4
H_6CDD	15	0,05	30	15	0,08	29	19	0,1	37
H_7CDD	25	0,02	49	30	0,2	58	37	0,1	72
O_8CDD	58	0,02	115	61	0,1	118	71	0,1	139
Sous-total (dioxines)	**108,70**		**215**	**116,90**		**225**	**138,80**		**271**
Furanes chlorés									
T_4CDF	90	0,03	178	100	0,08	193	120	0,08	234
P_5CDF	350	0,05	692	450	0,1	868	610	0,1	1 191
H_6CDF	24	0,02	47	33	0,06	64	43	0,1	84
H_7CDF	6,6	0,08	13	6,9	0,2	13	9	0,2	18
O_8CDF	3,3	0,03	7	3	0,09	6	3,5	0,06	7
Sous-total (furanes)	**473,90**		**937**	**592,90**		**1 143**	**785,50**		**1 534**
Total (dioxines + furanes)	**582,60**		**1 152**	**709,80**		**1 369**	**924,30**		**1 805**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD

FARNHAM - ÉTÉ 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	0,02	0,0	ND	0,08	0,0	ND	0,1	0,0
1,2,3,7,8-P_5CDD [1]	NDR	0,02	0,0	ND	0,02	0,0	ND	0,04	0,0
1,2,3,4,7,8-H_6CDD [1]	0,12	0,03	1,8	ND	0,05	0,0	ND	0,06	0,0
1,2,3,6,7,8-H_6CDD [1]	0,2	0,03	2,9	0,16	0,03	2,4	0,33	0,04	3,9
1,2,3,7,8,9-H_6CDD [1]	0,21	0,02	3,1	ND	0,04	0,0	0,28	0,04	3,3
1,2,3,4,6,7,8-H_7CDD	3,6	0,02	53,1	3,6	0,07	54,3	7,1	0,07	84,8
O_8CDD	27	0,02	397,9	26	0,05	392,1	58	0,09	692,5
Furanes chlorés									
2,3,7,8-T_4CDF [1]	0,13	0,02	1,9	ND	0,06	0,0	0,2	0,05	2,4
1,2,3,7,8-P_5CDF [1]	ND	0,03	0,0	ND	0,09	0,0	ND	0,1	0,0
2,3,4,7,8-P_5CDF [1]	ND	0,03	0,0	ND	0,08	0,0	ND	0,1	0,0
1,2,3,4,7,8-H_6CDF [1]	DNQ	0,04	0,0	ND	0,08	0,0	ND	0,08	0,0
1,2,3,6,7,8-H_6CDF [1]	DNQ	0,03	0,0	ND	0,05	0,0	ND	0,05	0,0
2,3,4,6,7,8-H_6CDF [1]	DNQ	0,04	0,0	ND	0,07	0,0	ND	0,07	0,0
1,2,3,7,8,9-H_6CDF [1]	ND	0,04	0,0	ND	0,08	0,0	ND	0,09	0,0
1,2,3,4,6,7,8,-H_7CDF	0,71	0,03	10,5	DNQ	0,2	0,0	1,2	0,2	14,3
1,2,3,4,7,8,9-H_7CDF	DNQ	0,03	0,0	ND	0,2	0,0	ND	0,3	0,0
O_8CDF	1,5	0,03	22,1	1,2	0,1	18,1	2,2	0,1	26,3
Total (dioxines + furanes)	**33,47**		**493**	**30,96**		**467**	**69,31**		**828**
Équivalent toxique total [2]	**0,138**		**2,0**	**0,079**		**1,2**	**0,224**		**2,68**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1999/07/12-13)			Jour 3 (1999/07/14-15)			Jour 5 (1999/07/16-17)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T_4CDD	0,35	0,02	5	ND	0,08	0	0,6	0,1	7
P_5CDD	ND	0,02	0	ND	0,02	0	ND	0,04	0
H_6CDD	1,3	0,02	19	0,36	0,03	5	1,1	0,04	13
H_7CDD	6,4	0,02	94	6,3	0,07	95	13	0,07	155
O_8CDD	27	0,02	398	26	0,05	392	58	0,09	693
Sous-total (dioxines)	**35,05**		**517**	**32,66**		**493**	**72,70**		**868**
Furanes chlorés									
T_4CDF	0,21	0,02	3	ND	0,06	0	0,54	0,05	6
P_5CDF	3	0,03	44	2,3	0,08	35	8,4	0,1	100
H_6CDF	0,82	0,03	12	ND	0,05	0	1,8	0,05	21
H_7CDF	0,71	0,03	10	0,8	0,2	12	1,2	0,2	14
O_8CDF	1,5	0,03	22	1,2	0,1	18	2,2	0,1	26
Sous-total (furanes)	**6,24**		**92**	**4,30**		**65**	**14,14**		**169**
Total (dioxines + furanes)	**41,29**		**608**	**36,96**		**557**	**86,84**		**1 037**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD.

JONQUIÈRE - ÉTÉ 98

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1998/09/14-15)			Jour 3 (1998/09/16-17)			Jour 5 (1998/09/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T$_4$CDD	ND	0,3	0	ND	0,07	0	ND	0,4	0
1,2,3,7,8-P$_5$CDD [1]	ND	0,2	0	ND	0,1	0	NDR	0,06	0
1,2,3,4,7,8-H$_6$CDD [1]	ND	0,5	0	ND	0,5	0	ND	0,4	0
1,2,3,6,7,8-H$_6$CDD [1]	ND	0,4	0	ND	0,4	0	ND	0,3	0
1,2,3,7,8,9-H$_6$CDD [1]	DNQ	0,4	0	ND	0,4	0	ND	0,3	0
1,2,3,4,6,7,8-H$_7$CDD	1.5	0,03	57	1,6	0,03	74	NDR	0,02	0
O$_8$CDD	4,7	0,2	178	5,8	0,04	268	5,9	0,02	281
Furanes chlorés									
2,3,7,8-T$_4$CDF [1]	ND	0,2	0	ND	0,2	0	ND	0,1	0
1,2,3,7,8-P$_5$CDF [1]	ND	0,2	0	ND	0,3	0	ND	0,2	0
2,3,4,7,8-P$_5$CDF [1]	ND	0,2	0	ND	0,2	0	ND	0,2	0
1,2,3,4,7,8-H$_6$CDF [1]	ND	0,2	0	ND	0,1	0	0,4	0,1	19
1,2,3,6,7,8-H$_6$CDF [1]	ND	0,2	0	ND	0,1	0	ND	0,1	0
2,3,4,6,7,8-H$_6$CDF [1]	ND	0,2	0	ND	0,1	0	ND	0,1	0
1,2,3,7,8,9-H$_6$CDF [1]	ND	0,2	0	ND	0,2	0	ND	0,1	0
1,2,3,4,6,7,8,-H$_7$CDF	ND	0,4	0	ND	0,4	0	ND	0,2	0
1,2,3,4,7,8,9-H$_7$CDF	ND	0,6	0	ND	0,5	0	ND	0,3	0
O$_8$CDF	0,34	0,03	13	0,47	0,02	22	NDR	0,02	0
Total (dioxines + furanes)	**6,54**		**248**	**7,87**		**364**	**6,30**		**300**
Équivalent toxique total [2]	**0,020**		**0,76**	**0,022**		**1,02**	**0,046**		**2,19**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1998/09/14-15)			Jour 3 (1998/09/16-17)			Jour 5 (1998/09/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T$_4$CDD	ND	0,3	0	ND	0,07	0	ND	0,4	0
P$_5$CDD	ND	0,2	0	ND	0.1	0	ND	0,06	0
H$_6$CDD	ND	0,4	0	ND	0,4	0	ND	0,3	0
H$_7$CDD	2.1	0,03	80	1,6	0,03	74	ND	0,02	0
O$_8$CDD	4,7	0,2	178	5,8	0,04	268	5,9	0,02	281
Sous-total (dioxines)	**6,80**		**258**	**7,40**		**342**	**5,90**		**281**
Furanes chlorés									
T$_4$CDF	ND	0,2	0	ND	0,2	0	ND	0,1	0
P$_5$CDF	ND	0,2	0	ND	0,2	0	ND	0,2	0
H$_6$CDF	ND	0,2	0	ND	0,1	0	0,4	0,1	19
H$_7$CDF	ND	0,4	0	ND	0,4	0	ND	0,2	0
O$_8$CDF	0,34	0,03	13	0,47	0,02	22	ND	0,02	0
Sous-total (furanes)	**0,34**		**13**	**0,47**		**22**	**0,40**		**19**
Total (dioxines + furanes)	**7,14**		**271**	**7,87**		**364**	**6,30**		**300**

ND : non détecté, DNQ : détecté non quantifié, NDR : détecté mais ne satisfait pas le rapport isotopique

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD

LA PRAIRIE - ÉTÉ 99

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T$_4$CDD	ND	0,6	0	ND	0,04	0	ND	0,4	0
1,2,3,7,8-P$_5$CDD[1]	ND	0,05	0	ND	0,02	0	ND	0,04	0
1,2,3,4,7,8-H$_6$CDD[1]	ND	0,07	0	ND	0,05	0	ND	0,06	0
1,2,3,6,7,8-H$_6$CDD[1]	ND	0,05	0	ND	0,04	0	ND	0,05	0
1,2,3,7,8,9-H$_6$CDD[1]	ND	0,05	0	ND	0,04	0	DNQ	0,05	0
1,2,3,4,6,7,8-H$_7$CDD	0,87	0,03	42	0,85	0,02	38	0,59	0,07	27
O$_8$CDD	5,7	0,08	276	6,8	0,04	301	4,2	0,07	192
Furanes chlorés									
2,3,7,8-T$_4$CDF[1]	ND	0,08	0	DNQ	0,05	0	ND	0,07	0
1,2,3,7,8-P$_5$CDF[1]	ND	0,05	0	ND	0,05	0	ND	0,06	0
2,3,4,7,8-P$_5$CDF[1]	ND	0,05	0	ND	0,04	0	ND	0,05	0
1,2,3,4,7,8-H$_6$CDF[1]	ND	0,02	0	ND	0,04	0	ND	0,04	0
1,2,3,6,7,8-H$_6$CDF[1]	ND	0,02	0	ND	0,03	0	ND	0,03	0
2,3,4,6,7,8-H$_6$CDF[1]	ND	0,02	0	ND	0,04	0	ND	0,04	0
1,2,3,7,8,9-H$_6$CDF[1]	ND	0,02	0	ND	0,04	0	ND	0,04	0
1,2,3,4,6,7,8,-H$_7$CDF	NDR	0,06	0	NDR	0,05	0	NDR	0,05	0
1,2,3,4,7,8,9-H$_7$CDF	ND	0,07	0	ND	0,06	0	ND	0,06	0
O$_8$CDF	0,29	0,07	14	0,43	0,03	19	0,22	0,05	10
Total (dioxines + furanes)	**6,86**		**333**	**8,08**		**357**	**5,01**		**229**
Équivalent toxique total[2]	**0,015**		**0,7**	**0,016**		**0,7**	**0,010**		**0,47**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1999/06/14-15)			Jour 3 (1999/06/16-17)			Jour 5 (1999/06/18-19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T$_4$CDD	ND	0,6	0	0,14	0,04	6	ND	0,4	0
P$_5$CDD	ND	0,05	0	ND	0,02	0	ND	0,04	0
H$_6$CDD	ND	0,05	0	0,18	0,04	8	ND	0,05	0
H$_7$CDD	1,8	0,03	87	0,85	0,02	38	1,1	0,07	50
O$_8$CDD	5,7	0,08	276	6,8	0,02	301	4,2	0,07	192
Sous-total (dioxines)	**7,50**		**364**	**8,00**		**352**	**5,30**		**242**
Furanes chlorés									
T$_4$CDF	ND	0,08	0	ND	0,05	0	ND	0,07	0
P$_5$CDF	ND	0,05	0	ND	0,04	0	ND	0,05	0
H$_6$CDF	0,12	0,02	6	ND	0,03	0	ND	0,03	0
H$_7$CDF	ND	0,06	0	ND	0,05	0	ND	0,05	0
O$_8$CDF	0,29	0,07	14	0,43	0,03	19	0,22	0,05	10
Sous-total (furanes)	**0,41**		**20**	**0,43**		**19**	**0,22**		**10**
Total (dioxines + furanes)	**7,91**		**383**	**8,43**		**371**	**5,52**		**252**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD.

LONGUEUIL - ÉTÉ 98

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T_4CDD	ND	0,01	0	ND	0,01	0	DNQ	0,01	0
1,2,3,7,8-P_5CDD [1]	ND	0,03	0	ND	0,02	0	DNQ	0,02	0
1,2,3,4,7,8-H_6CDD [1]	ND	0,02	0	DNQ	0,02	0	ND	0,02	0
1,2,3,6,7,8-H_6CDD [1]	0,09	0,01	22	0,17	0,01	48	0,13	0,01	33
1,2,3,7,8,9-H_6CDD [1]	0,18	0,02	44	0,16	0,01	45	0,12	0,01	30
1,2,3,4,6,7,8-H_7CDD	1,5	0,02	371	14	0,02	3 920	5	0,06	1 253
O_8CDD	18	0,02	4 446	410	0,01	114 800	150	0,01	37 600
Furanes chlorés									
2,3,7,8-T_4CDF [1]	0,15	0,02	37	ND	0,01	0	ND	0,02	0
1,2,3,7,8-P_5CDF [1]	ND	0,01	0	ND	0,01	0	ND	0,01	0
2,3,4,7,8-P_5CDF [1]	NDR	0,01	0	ND	0,01	0	0,04	0,01	10
1,2,3,4,7,8-H_6CDF [1]	DNQ	0,03	0	ND	0,04	0	DNQ	0,02	0
1,2,3,6,7,8-H_6CDF [1]	DNQ	0,02	0	ND	0,03	0	ND	0,02	0
2,3,4,6,7,8-H_6CDF [1]	ND	0,03	0	ND	0,04	0	ND	0,02	0
1,2,3,7,8,9-H_6CDF [1]	ND	0,03	0	ND	0,05	0	ND	0,03	0
1,2,3,4,6,7,8,-H_7CDF	NDR	0,3	0	ND	0,3	0	NDR	0,3	0
1,2,3,4,7,8,9-H_7CDF	ND	0,3	0	ND	0,3	0	ND	0,3	0
O_8CDF	3,5	0,03	865	39	0,03	10 920	11	0,02	2 757
Total (dioxines + furanes)	**23,42**		**5 785**	**463,33**		**129 732**	**166,29**		**41 683**
Équivalent toxique total [2]	**0,079**		**19,5**	**0,622**		**174,2**	**0,256**		**64,2**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1998/09/28-29)			Jour 3 (1998/09/30-10/01)			Jour 5 (1998/10/02-03)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T_4CDD	0,08	0,01	20	ND	0,01	0	0,04	0,01	10
P_5CDD	0,12	0,03	30	ND	0,02	0	0,49	0,02	123
H_6CDD	0,43	0,01	106	0,53	0,01	148	0,31	0,01	78
H_7CDD	2,7	0,02	667	26	0,02	7 280	9,6	0,06	2 406
O_8CDD	18	0,02	4 446	410	0,01	114 800	150	0,01	37 600
Sous-total (dioxines)	**21,33**		**5 269**	**436,53**		**122 228**	**160,44**		**40 217**
Furanes chlorés									
T_4CDF	0,15	0,02	37	ND	0,01	0	ND	0,02	0
P_5CDF	0,19	0,01	47	ND	0,01	0	0,13	0,01	33
H_6CDF	0,43	0,02	106	1,3	0,03	364	0,62	0,02	155
H_7CDF	1,2	0,3	296	15	0,3	4 200	3,9	0,3	978
O_8CDF	3,5	0,03	865	39	0,03	10 920	11	0,02	2 757
Sous-total (furanes)	**5,47**		**1 351**	**55,30**		**15 484**	**15,65**		**3 923**
Total (dioxines + furanes)	**26,80**		**6 620**	**491,83**		**137 712**	**176,09**		**44 140**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T_4CDD.

SAINT-GÉDÉON - ÉTÉ 98

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1998/09/15)			Jour 3 (/998/09/17)			Jour 5 (1998/09/19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T$_4$CDD	ND	0,3	0,0	0,7	0,2	0,3	ND	0,7	0,0
1,2,3,7,8-P$_5$CDD [1]	ND	0,1	0,0	ND	0,2	0,0	ND	0,01	0,0
1,2,3,4,7,8-H$_6$CDD [1]	ND	0,6	0,0	0,9	0,3	0,4	ND	0,01	0,0
1,2,3,6,7,8-H$_6$CDD [1]	ND	0,5	0,0	NDR	0,2	0,0	ND	0,01	0,0
1,2,3,7,8,9-H$_6$CDD [1]	ND	0,5	0,0	NDR	0,2	0,0	ND	0,01	0,0
1,2,3,4,6,7,8-H$_7$CDD	3,4	0,07	1,6	26	0,1	12,4	NDR	0,2	0,0
O$_8$CDD	18	0,1	8,6	75	0,05	35,9	17	0,01	11,2
Furanes chlorés									
2,3,7,8-T$_4$CDF [1]	ND	0,2	0,0	DNQ	0,3	0,0	ND	0,01	0,0
1,2,3,7,8-P$_5$CDF [1]	ND	0,2	0,0	ND	0,3	0,0	ND	0,07	0,0
2,3,4,7,8-P$_5$CDF [1]	ND	0,2	0,0	DNQ	0,3	0,0	ND	0,07	0,0
1,2,3,4,7,8-H$_6$CDF [1]	NDR	0,06	0,0	NDR	0,1	0,0	ND	0,01	0,0
1,2,3,6,7,8-H$_6$CDF [1]	NDR	0,05	0,0	0,9	0,1	0,4	ND	0,01	0,0
2,3,4,6,7,8-H$_6$CDF [1]	ND	0,06	0,0	0,7	0,1	0,3	ND	0,01	0,0
1,2,3,7,8,9-H$_6$CDF [1]	DNQ	0,08	0,0	ND	0,2	0,0	ND	0,01	0,0
1,2,3,4,6,7,8-H$_7$CDF	NDR	0,5	0,0	5	1	2,4	NDR	0,5	0,0
1,2,3,4,7,8,9-H$_7$CDF	ND	0,6	0,0	ND	1	0,0	ND	0,6	0,0
O$_8$CDF	ND	0,2	0,0	1,8	0,1	0,9	ND	0,01	0,0
Total (dioxines + furanes)	**21,40**		**10,2**	**111,00**		**53,1**	**17,00**		**11,2**
Équivalent toxique total [2]	**0,052**		**0,02**	**1,337**		**0,64**	**0,017**		**0,01**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1998/09/15)			Jour 3 (/998/09/17)			Jour 5 (1998/09/19)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T$_4$CDD	21	0,3	10,1	22	0,2	10,5	ND	0,7	0,0
P$_5$CDD	ND	0,1	0,0	ND	0,2	0,0	ND	0,01	0,0
H$_6$CDD	ND	0,5	0,0	0,7	0,2	0,3	ND	0,01	0,0
H$_7$CDD	7	0,07	3,4	51	0,1	24,4	ND	0,2	0,0
O$_8$CDD	18	0,1	8,6	75	0,05	35,9	17	0,01	11,2
Sous-total (dioxines)	**46,00**		**22,0**	**148,70**		**71,2**	**17,00**		**11,2**
Furanes chlorés									
T$_4$CDF	ND	0,2	0,0	ND	0,3	0,0	ND	0,01	0,0
P$_5$CDF	ND	0,2	0,0	2,2	0,3	1,1	ND	0,07	0,0
H$_6$CDF	ND	0,05	0,0	8,3	0,1	4,0	ND	0,01	0,0
H$_7$CDF	ND	0,5	0,0	5	1	2,4	ND	0,5	0,0
O$_8$CDF	ND	0,2	0,0	1,8	0,1	0,9	ND	0,01	0,0
Sous-total (furanes)	**0,00**		**0,0**	**17,30**		**8,3**	**0,00**		**0,0**
Total (dioxines + furanes)	**46,00**		**22,0**	**166,00**		**79,4**	**17,00**		**11,2**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD.

SAINT-JOSEPH-DE-BEAUCE - ÉTÉ 98

Congénères de dioxines et furanes chlorés : concentrations mesurées et charges

Dioxines et furanes chlorés Congénères	Jour 1 (1998/09/21)			Jour 3 (1998/09/23)			Jour 5 (1998/09/25)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
2,3,7,8-T$_4$CDD	ND	0,6	0,0	ND	0,3	0,0	ND	0,8	0,0
1,2,3,7,8-P$_5$CDD [1]	ND	0,3	0,0	ND	0,01	0,0	ND	0,1	0,0
1,2,3,4,7,8-H$_6$CDD [1]	ND	0,4	0,0	ND	0,01	0,0	ND	0,6	0,0
1,2,3,6,7,8-H$_6$CDD [1]	ND	0,2	0,0	NDR	0,01	0,0	ND	0,3	0,0
1,2,3,7,8,9-H$_6$CDD [1]	ND	0,2	0,0	ND	0,01	0,0	ND	0,3	0,0
1,2,3,4,6,7,8-H$_7$CDD	1,9	0,1	5,4	2,3	0,2	11,1	NDR	0,2	0,0
O$_8$CDD	4,9	0,5	13,8	2,8	0,01	13,5	4,1	0,01	15,9
Furanes chlorés									
2,3,7,8-T$_4$CDF [1]	1,9	0,5	5,4	ND	0,4	0,0	ND	0,4	0,0
1,2,3,7,8-P$_5$CDF [1]	ND	0,6	0,0	ND	0,3	0,0	ND	0,7	0,0
2,3,4,7,8-P$_5$CDF [1]	ND	0,6	0,0	ND	0,3	0,0	ND	0,6	0,0
1,2,3,4,7,8-H$_6$CDF [1]	ND	0,6	0,0	ND	0,01	0,0	ND	0,01	0,0
1,2,3,6,7,8-H$_6$CDF [1]	ND	0,4	0,0	ND	0,01	0,0	ND	0,01	0,0
2,3,4,6,7,8-H$_6$CDF [1]	ND	0,5	0,0	ND	0,01	0,0	ND	0,01	0,0
1,2,3,7,8,9-H$_6$CDF [1]	ND	0,6	0,0	ND	0,01	0,0	ND	0,01	0,0
1,2,3,4,6,7,8,-H$_7$CDF	NDR	1	0,0	ND	0,4	0,0	ND	0,4	0,0
1,2,3,4,7,8,9-H$_7$CDF	ND	1	0,0	ND	0,5	0,0	ND	0,6	0,0
O$_8$CDF	DNQ	0,1	0,0	0,26	0,01	1,3	ND	0,07	0,0
Total (dioxines + furanes)	**8,70**		**24,6**	**5,36**		**25,8**	**4,10**		**15,9**
Équivalent toxique total [2]	**0,214**		**0,60**	**0,026**		**0,13**	**0,004**		**0,02**

Dioxines et furanes chlorés totaux (groupes homologues) : concentrations mesurées et charges

Dioxines et furanes chlorés Groupes homologues	Jour 1 (1998/09/21)			Jour 3 (1998/09/23)			Jour 5 (1998/09/25)		
	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)	Conc. (pg/L)	LDM (pg/L)	Charge (µg/j)
Dioxines chlorés									
T$_4$CDD	ND	0,6	0,0	ND	0,3	0,0	ND	0,8	0,0
P$_5$CDD	ND	0,3	0,0	ND	0,01	0,0	ND	0,1	0,0
H$_6$CDD	ND	0,2	0,0	ND	0,01	0,0	ND	0,3	0,0
H$_7$CDD	3,3	0,1	9,3	4	0,2	19,3	ND	0,2	0,0
O$_8$CDD	4,9	0,5	13,8	2,8	0,01	13,5	4,1	0,01	15,9
Sous-total (dioxines)	**8,20**		**23,1**	**6,80**		**32,8**	**4,10**		**15,9**
Furanes chlorés									
T$_4$CDF	1,9	0,5	5,4	ND	0,4	0,0	ND	0,4	0,0
P$_5$CDF	ND	0,06	0,0	ND	0,3	0,0	ND	0,6	0,0
H$_6$CDF	ND	0,4	0,0	ND	0,01	0,0	ND	0,01	0,0
H$_7$CDF	ND	1	0,0	ND	0,4	0,0	ND	0,4	0,0
O$_8$CDF	ND	0,1	0,0	0,26	0,01	1,3	ND	0,07	0,0
Sous-total (furanes)	**1,90**		**5,4**	**0,26**		**1,3**	**0,00**		**0,0**
Total (dioxines + furanes)	**10,10**		**28,5**	**7,06**		**34,0**	**4,10**		**15,9**

ND : non détecté; DNQ : détecté non quantifié; NDR : détecté mais ne satisfait pas le rapport isotopique.

[1] : Ce résultat représente la concentration maximale possible car ce congénère peut coéluer avec d'autres.

[2] : Concentration totale de dioxines et furanes chlorés exprimée en équivalent toxique de la 2,3,7,8-T$_4$CDD

APPENDIX 14

LIST OF PESTICIDES ANALYSED AND DETECTION LIMITS

LIST OF PESTICIDES ANALYSED AND DETECTION LIMITS

PESTICIDES	**LIMITES DE DÉTECTION (µg/L)**
Analyse OPS : Pesticides organophosphorés (Méthode : MA. 403 – Pest. 3.0)	
Atrazine	0,04
Dééthyl-atrazine	0,03
Déisopropyl-atrazine	0,02
Azinphosméthyl	0,08
Butilate	0,06
Carbaryl	0,03
Carbofuran	0,05
Chlorfenvinphos	0,04
Chlorothalonil	0,06
Chloroxuron	0,11
Chlorpyrifos	0,02
Cyanazine	0,03
Diazinon	0,02
Dichlorvos	0,02
Diméthénamide	0,03
Diméthoate	0,03
Disulfoton	0,03
Diuron	0,14
EPTC	0,02
Fonofos	0,01
Linuron	0,06
Malathion	0,02
Méthidathion	0,02
Méthyl-parathion	0,02
Métolachlore	0,01
Mévinphos	0,04
Myclobutanil	0,02
Parathion	0,04
Phorate	0,05
Phosalone	0,03
Simazine	0,01
Tébuthiuron	0,16
Terbufos	0,04
Trifluraline	0,04
Analyse des phénoxyacides : Méthode MA. 403-P. CHLP. 2.0	
Bentazone	0,03
Bromoxynil	0,01
Clopyralide	0,1
2,4-D	0,01
2,4-DB	0,05
2,4-DP (Dichlorprop)	0,03
2,4,5-T	0,01
Dicamba	0,01
Fénoprop (Silvex)	0,01
MCPA	0,02
MCPB	0,02
Mécoprop	0,01
Piclorame	0,04
Triclopyr	0,01

APPENDIX 15

RESULTS OF ANALYSES FOR PESTICIDES

PESTICIDE CONCENTRATIONS DETECTED IN THE EFFLUENT OF THE CUM TREATMENT PLANT IN SUMMER 1999

Pesticides	Pesticides détectés (concentrations en µg/L)																														
	Mai							Juin													Juillet										
	17	18	19	25	26	27	31	1	2	7 (1)	8	9	14	15	16	21	22	28	29	5	6	7	12	13	14	20	21	22	26	27
HERBICIDES																															
2,4-D	0,19	0,14	0,70	0,40	0,18	0,20	man	0,39	0,27	<	0,12	int	0,21	0,23	0,21	0,35	0,09	0,56	0,37	0,20	0,32	0,21	0,07	0,06	0,08	<	<	<	0,07	0,17
Mécoprop	0,16	0,19	0,88	0,36	0,20	0,17	man	0,37	0,31	0,33	0,19	0,12	0,06	0,09	0,09	0,18	0,02	0,60	0,46	0,34	0,44	0,27	0,12	0,12	0,07	<	<	<	0,13	<
Dicamba	0,05	0,05	0,04	0,09	0,04	0,07	man	0,08	0,03	<	<	0,01	0,09	0,09	0,05	0,01	0,45	0,14	0,10	0,08	0,09	0,03	<	<	<	<	<	<	<	<
Bentazone	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0,11	<	<	<	<	<	<	<	<	<	<	<	<	<
Atrazine	0,06	<	0,20	0,11	0,06	0,05	0,05	<	0,07	0,08	0,13	0,07	0,09	0,09	0,08	<	0,06	0,07	0,06	0,05	0,57	0,09	0,05	0,03	0,04	0,05	0,03	0,06	0,07	0,07
DEA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0,15	0,38	0,86	<	<	0,33	<	<	<	<	<
DIA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0,03	0,10	<	<	<	0,04	0,05	0,05	<	<	<
Métolachlore	0,02	0,01	0,08	0,15	0,05	0,05	<	<	0,05	0,01	<	<	0,01	<	<	0,01	<	0,02	0,13	<	0,30	<	<	<	<	<	<	<	<	<
Diméthénamide	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0,06	<	<	<	<	<	<	<	<	<
Diuron	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0,47	0,15	0,16	<	tra	tra	<	<	<	tra	<	<	<
INSECTICIDES																															
Diazinon	<	<	<	0,06	<	<	<	<	0,06	0,04	0,10	<	<	<	<	<	<	0,02	0,04	<	<	<	<	<	<	<	<	0,06	<	<
Carbaryl	<	<	<	0,04	<	0,07	0,05	<	0,16	0,08	0,07	0,10	0,10	0,04	<	0,06	0,03	0,03	0,03	tra	<	0,04	0,03	0,03	tra	0,03	tra	0,03	<	<
Malathion	<	<	<	<	0,03	<	0,05	<	0,03	<	<	<	<	<	<	0,04	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Chlorpyrifos	<	<	<	<	0,05	0,04	0,04	<	0,03	<	0,04	<	<	<	<	0,02	<	<	tra	0,05	<	<	tra	<	tra	<	<	<	<	0,02
Dichlorvos	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

< : inférieur à la limite de détection
• : résultat rejeté
int : interférence
man : donnée manquante
tra : traces
(1) : volume de l'échantillon réduit de 50 %

PESTICIDE CONCENTRATIONS DETECTED IN THE EFFLUENT OF THE LONGUEUIL TREATMENT PLANT IN SUMMER 1999

Pesticides	Pesticides détectés (concentrations en µg/L)											
	19 mai				28 juin				7 septembre			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
HERBICIDES												
2,4-D	2,7	3,8	2,3	3,6	0,76	0,45	0,48	<	0,49	0,3	0,35	0,5
Mécoprop	2,1	4	2	4,3	0,63	0,41	0,39	<	0,54	0,23	0,4	0,67
Dicamba	0,33	0,38	0,24	0,34	0,07	0,07	0,04	<	0,03	0,02	0,03	0,05
MCPB	<	<	<	<	<	<	<	<	0,09	0,04	0,05	0,07
Atrazine	0,14	0,18	0,12	0,19	0,06	0,12	0,09	0,11	<	<	<	<
DEA	<	<	<	<	<	<	<	0,05	<	<	<	<
Métolachlore	0,09	0,11	0,12	0,12	0,04	0,14	0,11	0,13	<	<	<	<
Diméthénamide	<	<	<	<	<	tra	tra	tra	<	<	<	<
INSECTICIDES												
Diazinon	0,11	0,17	0,07	0,07	0,03	0,05	0,03	0,03	<	<	<	<
Carbaryl	0,15	<	<	<	0,03	<	<	<	<	<	<	<
Malathion	<	0,2	0,1	0,09	tra	<	<	<	0,02	0,02	<	<
Chlorpyrifos	<	0,1	0,07	<	0,03	<	0,23	<	<	<	<	<
Diméthoate	<	<	0,15	<	<	<	<	<	<	<	<	<
Carbofuran	<	<	<	<	<	<	0,08	<	<	<	<	<

< :	inférieur à la limite de détection
tra :	traces